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OF
INDIA.

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ORIGINAL COMMUNICATIONS.

"A body of men engaged in the same pursuit, form a joint stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all."—REV. DR. WILLIAM CAREY.

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ART. I.—*Essay on Cotton Culture.*—By P. SAUNDERS Esq,
Government Cotton Commissioner,

IN writing this Essay I shall not adhere strictly to the Rules laid down by the Agricultural and Horticultural Society, because the expenses of experiments in one spot of ground, will not apply to experiments made in different parts of the country; and I believe I will meet the views of the Manchester Cotton Supply Association and the Agricultural and Horticultural Society, if I write an Essay pointing out the best methods of culture of the cotton plant in the various large districts of this side of India, extending from the Sewalick range of Hills in the N. W. Provinces to the confines of North Eastern Bengal. No part of this Essay will be derived from books, but from personal observation and study of the cotton plant, and the various soils in which it is grown.

For the successful cultivation of cotton in this or in any country, the cultivators must be acquainted with the leading conditions of soil and season necessary to that success; and, before touching upon the subject of cultivation. I shall describe these conditions.

Soil.

The soil for cotton may be sandy, as in the Jumna and Ganges Doab, and in the Hills of Assam, Cachar, and Chittagong; or it may be black, as in the Trans-Jumna territories, and many parts of Bengal; but it must be porous, and of a depth of not less than 3 feet. The taproot of the plant penetrates to a considerable depth, and if it encounters rock, or gravel beds, or Kunkur beds, it fades and dies. The soils, in the countries mentioned, generally are deep, but occasional beds of Kunkur &c occur which have caused the failure of experimental crops of Exotic seed, which failure has been attributed to soil and climate. At Newabgunge in Oude I observed a garden of exotic cotton in which the plants were dying after having attained a height of two feet. I noticed at once that the soil rested on a large bed of Kunkur, and explained to the cultivator that the moment the taproot reached the Kunkur bed it could find no further nourishment and the plant must die. He had already come to the conclusion that the soil or climate was unsuited to it. Soil of an adhesive clayey kind is not suitable to cotton. There is much soil of this kind in Bengal, in some parts of Oude, the plains of Cachar, Assam, &c. In this soil the cotton grows, but it does not grow luxuriantly. The soil becomes baked and hardens rapidly round the plant, causing it to maintain a feeble existence, and the crop produced is scarcely worth gathering. Again the land must not be subject to inundation, as water lodging at the root of the cotton plant soon kills it.

Season.

The season for growing cotton must be observed and attended to. If we can get rain for ploughing and sowing, rain during the growth of the plant, rain while it is flowering, and dry warm weather for podding and picking, we obtain all the essentials for securing a fine crop of cotton. We have these essentials in almost every part of India that I am acquainted

with, and when they do not exist in their entirety we have the command of irrigation to supply the deficiency. In the Southern states of America, which lie between the thirtieth and thirtyseventh degrees of latitude, the Cotton planters are obliged to sow early—say in March or April, as they sometimes suffer severely from early frosts. But then they are exposed to heavy rains while the cotton trees are podding, and thus suffer much damage from early sowing. Our territories, which lie within the tropics, are not exposed to frosts, and we can select the proper time for sowing. In the North West Provinces the cotton seed should be sown not earlier than the 15th June and not later than the 1st of July. If the rains do not commence by the 15th of June or 1st of July, the land should be prepared and the seed sown by irrigation either from canals or wells. In this way the cotton will commence to pod about the end of September when the rains cease, and no climate in the world can be finer than the months of October November and December in the N. W. P. for podding and the picking of the plant. The same may be said of Oude, Berar, and hills of Assam, Cachar, and Sylhet, and Chittagong. In Assam, Cachar, Sylhet and Chittagong however, spring rains commence in March, and the planter must not be tempted by these early rains to sow cotton. If he does, the cotton will be podding and ripening before the heavy periodical rains are past, and will be severely injured according to the greater or less severity of the rains. The planters in these countries ought not to sow their cotton before the 15th June. In the lower districts of Dacca and the Soonderbunds it may be proper to sow in October or in November, immediately after the heavy periodical rains cease. The heavy fogs and dews of the cold weather answer all the purposes of irrigation, and the cotton will flower and pod with the spring and summer sun; but the planters in the vast territory of India must select the proper season for sowing cotton according to the climate of the particular provinces in which they may be located, attending

to the condition of climate and soil under which Cotton flourishes.

I have dwelt with particularity on these points, as I have seen exotic cotton sown at all seasons, and at any season; sometimes in February and March, and it then pods too soon, and is greatly damaged by heavy rains; sometimes in July and August and it then pods in the cold weather, and the flowers are few, and the pods small and shrivelled.

Exotic Cotton seed.

The selection of good seed is a point of the greatest importance. Half the experiments in the country have failed from sowing bad seed. It is not easy to obtain good seed from America or Egypt, as it is liable to be damaged in the passage, or from bad packing, or from bad preparation of the seed before it is packed. If India becomes an Exotic cotton growing country on a large scale, we must not depend upon imported seed. The seed from the exotic cotton grown by planters, especially if care is taken to select the largest pods, will do very well for a few years; and when a change becomes necessary the planter of the North West could obtain seed from N. E. Bengal and vice versa. Again exotic seed might be occasionally imported and sown in a field solely for the purpose of procuring seed. What I would impress upon planters is not to trust to imported seed to sow a whole plantation. If they do, and the seed proves bad, they lose the season. New Orleans* and Egyptian seed will be the best for the N. W. Provinces, Oude, Berar, and the teelas or hills of Assam, Sylhet, Cachar, and Chittagong; while Sea Island seed will be the best for the Soonderbunds and the lowlands of the sea coast.

* NOTE BY ONE OF THE COMMITTEE OF PAPERS.

This is doubtful. With deep cultivation on the sea soil, such as is found about Hazareebong, Sea Island and Egyptian seed have been found to do better than New Orleans, sending down a tap root 18 to 20 inches.

Preparation of land.

The land should be well ploughed after the first rain, or after irrigation if rain does not fall in time. When ploughing is difficult or impossible it should be well hoed, and for that purpose I strongly recommend the hoe used by tea planters with long handles. The short handled shovel shaped hoe, used in the North West and other parts of India, is a worthless instrument.

Sowing.

Exotic cotton should be sown in lines four feet apart, and the seed should be deposited at a distance of three feet from each other. The best way to do this is to have lines of cord knotted at the distance required, (three feet) and to stick bamboo stakes in the ground at the site of each knot. Two coolies hold the line over the field, and one passes up, placing the stakes where required. After the ground is staked out the sowing should be commenced. With a hoe the ground should be turned up where the stake is inserted, and four seeds planted at distances about one inch from each other *in the line*, and about $1\frac{1}{2}$ inches deep, and then they must immediately be covered with earth by the hand or with a small stick.

This method of sowing is easy and saves a great deal of trouble afterwards. It secures at once a good line, and saves the trouble of thinning and selecting the plants that must be thrown away, which is the case when seed is sown in the furrow. When the four seeds come up (supposing they all germinate) and grow to the height of seven or eight inches, it is easy to throw away the supernumerary plants leaving the best standing, for only one plant must be left in one point. The planter should prepare some thousands of bamboo stakes when the fields are ready for staking; and the stakes should be removed when the supernumerary plants are thrown away.

Weeding.

The planter will be entirely guided by the appearance of his cultivation to commence weeding. The first weeding, when the plant is small, should be by hand; but afterwards it will be found that the hoe or the plough does the double duty of turning over the weeds and loosening the soil. In hoeing or ploughing the planter should be careful not to injure the lateral roots of the plant. As the plant grows up, ridging, or throwing a little fresh earth on the stem of the plant to a height of 5 or 6 inches at the time of hoeing, is very useful. When the rains are heavy this ridging prevents water from lodging at the root of the plant which is very injurious to it.

Irrigation.

Cotton is a plant that, although it languishes and dies when long inundated, must not remain long without moisture.

There are often breaks, as they are termed, in the periodical rains, that is intervals of fifteen, twenty, and even thirty days, when there is no rain. The plant must then be irrigated, or it will cease to grow and the crop will be very poor. In low moist lands irrigation may not be required, but the planter must judge of the necessity of irrigation by the appearance of the plant. Cotton in flower especially must have moisture, and I have seen so often, and in so many places, the benefits arising from irrigation, that I have no doubt of its great value. In my report on the Province of Oude, in the Section on Cotton, I give some experiences of the excellent results of irrigation.

Topping.

In this climate of powerful sun and heavy rain vegetation is most luxuriant, and exotic cotton is very apt to run to wood; and when this is the case it flowers very scantily. When the planter notices that the cotton is growing too high before flowering, he should proceed down the lines with hedge-cutting

scissors, and clip off the top of the main stem. This will check the upward growth, cause the plant to branch out laterally, and secure a good crop of pods.

Picking.

The pods should be picked when they are beginning to open, and after noon, when the morning dews are dried up by the sun. Picking should not be carried on in showery weather if it can be avoided ; but if it is unavoidable, the pods should be housed apart and dried in the sun on the first opportunity. It will be advantageous to have two coolies on each line—one to pick the larger pods, to be followed by the other gathering the smaller that are left. In this way the separation of the qualities will be better kept, as one cooley with two boys would be constantly making mistakes and mixing the large and small together.

Cotton should be housed in godowns or bamboo sheds, with raised machauns or shelves of bamboo, on which to place the cotton. Cotton heaped on the ground gets dirty and often becomes damp and discoloured. Both colour and fibre suffer from dampness.

Cotton in Tea lands.

I have long had an idea that the Tea planters of Assam, Sylhet, Cachar, and hereafter of Chitagong, would utilize their plantation by growing cotton in the tea lines. For two years the tea plant is small and requires shade, and during these years weeding must be constantly attended to, and adds much to the expense of the garden.

If cotton was sown in the lines, it would assist in shading the tea plants and keeping down weeds, and would not exhaust the soil any more than the rank vegetation which is constantly springing up in these countries. The cotton ought not to be sown between the lines for this would prevent hoeing, but after this fashion. Suppose the following are lines of tea six

feet apart, and the tea trees, represented by O's, are four feet apart, then the cotton should be planted where the asterisks

O — * — O — * — O — * — O — * — O — * — O

O — * — O — * — O — * — O — * — O — * — O

are. In these tea countries hundreds of acres of new lands are being brought into tea cultivation, and I see no good reason why two crops of cotton should not be taken from them while the tea trees are young.*

Conclusion.

I believe that cotton cultivation will be very successful in India if the above rules are followed, and the conditions of soil and season are attended to. And I believe a short and simple Essay of this kind will be infinitely more useful than the most elaborate Essay on the history of cotton, and its numerous varieties. Of what importance is it to the practical agriculturist to learn that the knowledge of cotton is as ancient as history itself, that it has been mentioned by Herodotus, Pliny and Theophrastus, and that it has been found by the first discoverers in America, and the first travellers in China? It would be of no practical use to the cultivator to describe the numerous varieties of the cotton tree, when the two mentioned will suit his purpose and are the most easily obtained. I will not touch upon these subjects, but send in the present little Essay, or treatise, or whatever it may be called, with no expectation of gaining prizes or medals, but in the hope of its proving useful, should the Agricultural Society think it worth printing and distributing.

P. SAUNDERS,

* NOTE BY ONE OF THE COMMITTEE OF PAPERS. I did this last year, and it answers very well for the Cotton, but it is *certain death to the tea*.

Mr. Charles Maddox's Essay on the Cultivation of Cotton.

GENTLEMEN,—I, sometime since, forwarded to the Manchester Cotton Supply Association, an account of my investigations in South Africa and elsewhere in search of a new field for the growth of Cotton. From various causes, the principal one the want of labor, I found there was little prospect of success in the places I went to, viz. the Cape Colony and Natal. I then turned my attention to the East, which gave a fairer prospect of success, and staid at Java, where, from observation and enquiry made, I found that though the place had many elements of hope in a fine soil and favorable seasons &c. that no foreigner would meet with any assistance from the government, but rather find obstacles thrown in his way. Here cotton is cultivated to a small extent, and as I wished to open a new field rather than pursue it in one already opened, I continued on my journey towards India. On my way there, from the representations of the Governor of the Straits settlement, and others anxious for the success of the culture of cotton, I was led to survey the Malay Peninsula, which was suggested as a probable place for its successful growth: it also possessed the attraction to me of being a place where the experiment of growing cotton as an article of commerce had not been made. After some deliberation, the part known as the Province Wellesley, a tract of land opposite to Penang, was fixed upon as the place offering the most advantages, and in the early part of the month of June 1861, steps were taken to obtain ground and commence a plantation upon a small scale, as a trial of the capabilities of the place. The result of that trial, I now propose to place before you, believing it will be in strict conformity with the rules laid down by you for competition, the whole of the statements given being from my own observations and experiments.

Preliminary Observations.

Province Wellesley is a narrow slip on the main land of the

the Malay Peninsula, directly opposite to Penang, being separated from it by the straits, here about 2 miles wide, 32 miles long, and varying in width from 13 miles to somewhat less than 5 miles in its narrowest part, which is nearly the centre of the Province. It was originally ceded by the Rajah of Kodah in the year 1801, and was then a mere strip of coast, little more than 3 miles in width. It was increased to its present limits by a treaty made with the Siamese Government in the year 1831. The entire area consists of 286 square miles, and should it be desirable to extend it, little doubt is entertained of the willingness of the Siamese Government, to dispose of a considerable portion of it adjoining the British Territory.

General Features.

Although the extent of territory is so small, a marked difference is found in the geographical character of the northern and southern divisions of the Province. The entire coast of the northern division, from the mouth of the Moodah River to the mouth of the Pry, presents a fine sandy beach, backed by a *permatang*, or sandy ridge, generally covered with cocoanut trees. Within the sand ridge there is a *payah*, or swamp, varying in width from a few score yards to several furlongs, well adapted for the culture of rice, and almost invariably appropriated for that purpose :—Behind this rises a second sand ridge, followed by a second swamp, and so the country alternates from narrow ridges of sand studded with cocoanuts and Malay dwellings to extensive paddy fields for several miles inland, when the country becomes a little more elevated, and was covered with Forest when the province was first ceded. An elevation of 10 to 12 feet above the level of high water is sometimes attained, but beyond this there is no high land throughout the northern district.

The sea coast of the southern division of the Province, on the other hand, is every where fronted by extensive banks of

slimy mud, which are left uncovered at low water spring tides. These are backed by broad belts of mangrove, beyond which the system of *Permatangs* and *Payahs* continues as in the northern division, and extends as far inland as the face of the hill range. There are not less than 5 parallel ranges in this division of from 200 to 600 feet in height, running nearly N. and S. where the width of the territory is little more than 10 miles, with several detached hills of various altitudes, the highest "Martajam" being 1840 feet high and covered with forest.

Soil.

The land at the base of these ranges, and on the gentle slopes of the hills, is the best adapted for the growth of cotton being of a light sandy loam in character, frequently impregnated with a rich deposit of decayed vegetable matter.

Climate.

From its geographical position, being in Lat $5^{\circ} 7'$ to $5^{\circ} 34'$, N. Lon. $100^{\circ} 30'$ E. there is little definition of seasons; and this circumstance is the only important drawback to the perfect success of cotton culture here. As the data of previous years, though carefully recorded, may vary considerably from the corresponding time of operations, this uncertainty of the periods of dry weather and of rain falling must occasionally interfere with the success of its culture. The mean temperature of 1861 was $80^{\circ}.4$, highest temperature registered throughout the year 87° , lowest 73° : rain fell on 140 days; entire quantity that fell 98.6 inches, the most rainy month October, the driest month June; the longest period without rain 20 days. The rain fall was above the average this year: the preceding year rain fell on 115 days, and the entire quantity that fell was 85.5. Though some months varied also in not being either the most rainy or the dryest, these changes of the times of rain and drought are perplexing, as they cause doubt about the right time of planting, for the most favorable time for the maturing of the crop.—

Population.

The Province contains about 64,000 inhabitants, of which number there are less than 100 Europeans; the greatest proportion being Malays, being about 53,000; the remainder are Chinese, natives of India, and a few Siamese.—The proportion of Malays is greater in the northern district than elsewhere, as the nature of the country is favorable to the mode of life which they most esteem. Their dwellings are erected on the Permatangs, under the shade of the Coccoanut trees with which they are thickly studded, and the bulk of the male population is employed, during the intervals of planting and reaping the paddy lands, in forming and tending the fishing weirs, which extend far out to sea on the bank that lines the shore, and which yield an abundant supply of excellent fish at all seasons of the year. The Chinese are mostly employed as shopkeepers, hawkers, or manufacturers. Of the native Indian population, the Bengalis are mostly breeders of cattle, in good circumstances, while the Klings are chiefly employed as coolies on the various estates in the province. Of these various classes mention will be made under the head of labour available for a plantation. There are several European plantations here, chiefly of sugarcane; also of the Cassava-root from which Tapioca is manufactured, and the cocoa and betelnuts are extensively planted.

Government.

The Province is a dependency of Penang, and the chief local authority is an assistant to the Resident Councillor of that Island, and is also Magistrate of Police &c. &c. An European Inspector of Police resides in the northern part of the Province, and another in the southern district, and small detachments of Police under native officers are stationed at most of the principal villages. The waste lands are at the disposal of the Surveyor General of the Straits, and the roads, bridges, and public buildings are maintained by the Public Works Depart-

ment of Penang, the repairs being effected by convicts from India. I will now proceed, after these introductory observations, to give you a detailed statement of the experiment that has been made here.

Situation.

The spot fixed upon is a tract of land in the hands of the Government, at the base of a hill of about the altitude of 500 feet, and which had been partially cleared of jungle. It comprises about 250 acres, inclusive of the hill; and a large portion of the land, including the gentle slopes of the hill sides, is suitable for growing cotton. The streams of water from the hill are of great value, as they supply wells which have had to be dug for the use of the coolies, who require a large quantity of water for bathing &c, and if not supplied to them will leave. The situation is also a healthy one, as the general slope of the land carries off the surplus water to a lower place on the estate, which will not at present be cultivated. The distance from the strait opposite to Penang is about 7 miles, and the Government have recently opened, at their expense, a canal to the Straits, distant from the estate less than one mile, capable of forwarding the produce of the estate by means of native boats direct to Penang in 5 or 6 hours. The roads are generally good, and manure is easily obtainable from the various Malay and Kling *compongs* in the district, only chargeable with the expense of carriage. Wood is abundant and suitable for building purposes, an important item as many houses are required for the coolies. The neighbourhood is principally peopled with Malays and Chinese, who, being engaged in agriculture and trade, are peaceable; no offence has been committed near the Estate since being here, although it borders on the Siamese Territory. I think the people of that place are favorable to an extension of the plantation into their country, but this would be a matter for mature consideration, in the event of wishing to extend it in that direction, as a

considerable amount of land is available for the purpose in the British Territory.

Soil.

The nature of the soil here is of a light sandy loam, of several different qualities; in some places being light but very rich, from accumulated vegetable deposits, forming a black loamy soil; in others sandy, and requiring more or less manure for the continued cropping of cotton. The land in many places is covered with trees of considerable size, principally fruit trees, of quick growth but early decay from the ravages of insects, the different kinds of ants being very prolific here; but they have not been observed as destroying the cotton plant, but rather, by preying upon some injurious insects, favorable to its success.

Labor.

On this subject I must premise that considerable difficulties lie in the way of a new enterprize: whatever the assistance of the Government (and I will here remark every assistance that could be legitimately rendered has been given by the Government officials, as to giving assistance in exploring the country, pointing out the best localities, as far as they knew, and in giving protection when they deemed it necessary) you will find upon arriving in a place where you are a stranger great obstructions to your progress. Every one conversant with the character of Eastern nations will know that their object is to deceive, and from my experience here I have found that the native mind is devoid of gratitude. If you wish to treat them with generosity, they will repay you with less attention to your interests, believing by your offer or concession, that some further one will be granted; and it is only by the strictest adherence to a just rule, in which the greatest firmness must be shown on your part, and an implicit obedience on theirs; that a contract entered into for a certain amount

of work, for a certain amount of pay, can be carried out. The least deviation from this course causes great difficulties; for the stubborn nature of some, and the apathetic nature of the others, will induce men to leave a place, when by a certain amount of toil they can earn more than in any other occupation.

I now proceed to give you an account of the laborers employed here and the wages given to them. First the Chinese, as the highest order, being mechanic, and men in a position to make contracts, for building &c. their wages are from 16 cents to 20 cents per day—equal to $\frac{1}{3}$ to nearly $\frac{1}{2}$ rupee per day, working ten clear hours per day, i. e. from 6 till 6, excluding 11 O'clock A. M. till 1 O'clock P. M. They are good workmen compared with the other laborers to be obtained here, but very difficult to turn from their preconceived notions of doing things, and will sometimes relinquish a contract if thwarted although it is to their benefit to complete.

They are also contractors for preparing land, but require a large advance, equal to one half, before commencing work; and then it is necessary to get the bond of a substantial Chinese for their due performance of it: they work well in the field if very carefully looked after, but will take every opportunity to shirk their work otherwise. The price paid to Chinese contractors is from 20 to 23 dollars per Orlong = 16 to 18½ dollars per acre, or 36 to 43 rupees per acre, for clearing land when covered with jungle; and from 16 to 18 dollars per Orlong = 13 to 14½ dollars per acre, or 30 to 33 rupees per acre, for land not so covered. Next come the Malays: they are a more independent race, being the original possessors of the soil, and many, having vested landed rights granted to them formerly or purchased from the Government from time to time, are able to maintain themselves upon the small portions of land they possess, which enable them to live with their families upon its produce: from this cause, though they form by far the largest element of the population, being about five-sixths of the

whole number, it is almost useless for hired labor, they being with few exceptions employed in their paddy fields; and it is only in the interval from reaping to planting that their labor is to be obtained. They are good builders of native houses, such as are here required for the coolies.

This is the most valuable feature in their labor as the need of houses for laborers is constantly arising, from the continual acquisitions of men; and the cost for the completion of a house fitted for 50 men is, with materials and labor combined, not more than 50 dollars or $112\frac{1}{2}$ rupees. Their labor is also to be obtained on the estate as cultivators of the land; but, from the above stated causes, at the time their labor is required they will leave for their own cultivation, and only in the early stages for preparing the ground their services are useful.

The most important source of labor is derived from the native population of India, viz. the Klings: these are the men who supply all the plantations that are worked here, with the bulk of labor, but the supply is inadequate to the demand, and there is a lively competition for them upon the arrival of any vessel;—(from the general success of the plantations established here the wish of the proprietors is to extend them). These are secured by the payment of their passage money to the Captain of the ship, and they enter into an engagement to give their services for as long a time as the debt remains, and the additional one of advances for food &c.: this labor is the best, for as the men are anxious to shorten the time of their engagement, they work better, and so a greater certainty of calculating the time the several operations in the fields require is to be obtained; which is not the case with men when they have completed their engagements, as they can give way to their natural feeling of indolence, and knowing that every estate is always open to receive them (and the cost of their maintenance is very small) their labor is not to be relied upon; in a cotton plantation, when at certain seasons labor re- be immediately available, the absence of a sufficient

force at the time required is one of the impediments to success (I am now speaking particularly of the formation of a plantation, and this difficulty would be in a much smaller degree after its establishment.) The wages paid to them is at the rate of 10 to 13 cents per day, equal to about $\frac{1}{4}$ rupee; each man's work for the day, or part of it, being recorded every evening, and the payment made monthly; few men work for the whole month, either from sickness, weakness, or more frequently from disinclination. There is a more valuable class of labourers to be found in the Javanese, who are to be obtained by the same means, viz, the payment of their passage money: these men are more industrious than the Klings, but their number is relatively small, and as soon as their engagement is out they are desirous to return to their country, which is not the case with many of the Klings who will remain for a long period on the estates after it has terminated.—The wages paid are about the same; and could they be induced to remain as permanent labourers, they would form a valuable addition to the now scarce supply of effectual men, one of the primary items of importance in a cotton or any other plantation.

Implements.

The only implement used is the *chonkle* or hoe, (in size about 12 inches long by $7\frac{1}{2}$ wide at edge) by all classes of labourers for the breaking up of the ground: this requires to be done twice; the first time occupies much less time than the second, which is generally done about 1 month to 6 weeks after the first, when the ground is broken up to a sufficient fineness for the planting of the seed. The object of this process is to remove every particle of the root of a coarse, tall grass, here called *Lalang*, which penetrates deeply into the soil, and if not thoroughly exterminated causes considerable inconvenience by its reappearance when, or after, the seed is planted. This root is allowed to remain exposed to the

action of the weather for the time mentioned above, and is then collected by means of rakes and burnt on the ground.

Seed.

Some Egyptian seed was obtained via Bombay and has yielded fairly, although it has a large admixture of old seed. Several acres have been planted with it, and when it was proved in an early stage of planting that several of the seeds were unfertile, the difficulty was removed to a considerable extent by a greater number of seeds being planted to allow for the non-appearance of the barren. Since then we have received direct from Egypt several casks of "Mahoe," fresh seed from the last crop; it has arrived in good condition and promises well; it is a fine sound seed, firm and black, free from any fibre; our hopes are strong from the fine stand it presents; the land already planted shows a very healthy growth, and it is intended to plant all the land with it as far as it will go, which, from its soundness, will be adequate to more than twice the quantity of the other. I have no doubt of the success of the Egyptian here; it has not to contend with much difference of climate, and several features of the seasons here accord with the places where it is successfully grown.

There is one other variety here, the "*Gossypium peruvianum*" or the Pornambuco. This is to be found in many places on the Malay Peninsula, and also in many of the East Indian Islands. It does not appear as indigenous, but to have been introduced at some former period, and spread through the desire to cultivate it more as an ornament than as an article of value, as the only use made of it here is in its raw state for domestic purposes, such as the stuffing of beds, pillows, &c. there never appears to have been any idea of its value as an article of cultivation for the purposes of manufacture until the starting of this plantation, and several persons who disregarded it before are paying attention to its culture, and I have no doubt will be able to contribute to the

general stock a moderate but not unimportant quantity of this desirable article. There are trees now standing that have borne for 3 or 4 years, on one of which was counted 345 holes: this was probably an exception to its average produce, but as trees of from 8 to 18 months have frequently yielded from 80 to 120 matured pods, it is not unreasonable to suppose that this is not far above the average yield of trees of its age. I will here remark that the cost of planting and subsequent attention this variety requires is less than every other kind, and though its produce is deferred for a longer time than the annual varieties, and its produce realizes less per ratio in weight, it is, from its great counterbalancing properties of less cost in production, and much larger yield in weight, entitled to the serious consideration of planters, who wish to derive the greatest amount for the capital they invest. With a wish to make a fair trial of every kind that appeared suitable for this place, and forming a favorable opinion of its value from the before mentioned circumstances of its comparatively inexpensive culture and its superior quality of yielding, combined with its having become inured to the climate, several acres have been planted at different times to test its relative value in comparison with others; and I am bound to state my conviction that this kind, from its robust growth, offers the best prospect (I believe a certainty) of a sure and remunerative crop. This I state, as to the less enterprising capitalist it offers, I feel assured, a safe means of investment; while the experiment of producing cotton of a more valuable nature in proportion to its weight requires a longer period to demonstrate its complete success, from the fact of its perfect novelty here and its natural delicacy.

There is one established fact, that Pernambuco will stand transplanting well; and I believe time will show, that the transplanted plants, though retarded in their growth, instead of suffering from the process will be ultimately benefited by it.

In support of this opinion I must state that a small piece of land, about half an acre, was planted; the seeds were placed in the ridges in their conglomerate form; averaging from 6 to 10 each, and after remaining there for rather more than 2 months were transplanted singly to a piece of ground about 5 acres, and out of the whole number the loss was less than 3 per cent. The field now presents a most promising appearance, the plants having a uniformity of growth and healthy look, most encouraging for pursuing future operations in the same mode.

Time, Mode &c. of Planting.

From the Meteorological tables kept here, and from my own personal observations, recorded several times during the day, I was induced to think the proper time for planting would be at such a period as would throw the early blooms into the beginning of June; as the months June and July appear, upon the average, to be the driest months of the year; but, as a preliminary step to prove the most favorable, and the influence of the least so, I have planted small plots of land, not exceeding a quarter of an acre each, at different times, to serve, if I may so express it, as a cotton Barometer, from whence (a strict record being kept) to obtain data for longer operations at a future time.

From this it appears there is little difference in the time of maturing, but very great in the produce; for instance seed planted in the month of August showed its first blooms the beginning of November, and matured cotton about the middle to the end of December, a few pods coming until the end of January: this was subjected to very heavy rain at intervals for several weeks after its appearance, rains of sufficient violence to break through the ridges in several places, and would necessitate the extension of drains to a considerable extent greater than was contemplated in the laying out of the land. This remark applies to the time just mentioned, the first of

the series of experiments to test the most suitable time for planting and securing the crop.

On this small scale, every month, seed has been planted, and the result at present is to show that the time of maturing, if brought into the months of January, and February, would be favourable, as next to June and July they are the most certain months of dry weather. In the month of March rain commences and April is a certain wet month, with less moisture in May, on this data the bulk of the seed has been sown during the latter part of March, so as to secure the rain for its first growth, and the dryest season for flowering &c. It is favourable that two crops of cotton could be attained here in the course of the year, by the planting at the end of the months of October and March, which would throw the blooming &c. into the months of January and February, and June and July respectively. This course would require a much larger quantity of manure, which is obtainable from the natives at the cost of carriage only, and the purchase of Guano, to be obtained from several of the Islands of the Eastern Archipelago; this does not possess the strength of Peruvian, but is more valuable for cotton land, and can be purchased for 10 to 12 dollars per Coyan in weight, equal to about 2 Tons, = $11\frac{1}{2}$ to $13\frac{1}{2}$ rupees per Ton.—This, with an admixture of the cattle manure, is found to be very suitable for cotton land here. The system of planting here adopted has been the ridge system, of distances 3×3 feet, in the experiments made to test the variations of the seasons with regard to the Egyptian; and 6×6 for Pernambuco, from the rapid growth of the plant and the size it attains, it was decided to plant all the Egyptian at a distance of 4×4 , and the Pernambuco, 8×8 , and the whole of the estate has been planted in these proportions; the sharp hill sides have been laid out in hills of the distance of 4×4 , each hill having a diameter of 2 feet and well raised; in this is placed a good supply of manure with sand, and then covered up till the seed is planted; this

plan appears to answer well, as the heavy rains find their way to the middle land between the hills (where if ridges were made they would be broken down) and are caught in large drains to be taken off the land cultivated lower down.

Produce.

The first to be mentioned is from the seed of the Pernambuco. This is undoubtedly a sure production here: its yield on the average of the land planted with it (a small portion) as it was intended to plant only Egyptian, is during the first year of its growth more than 12 ozs of clear cotton per Tree; but taking the weight at the lowest average as $\frac{3}{4}$ of a lb per tree, it will give a total of 450 lbs. from the acre; and assuming its value to be 20 cents = 10d per lb, about the price it brought in 1860, (and much below the enhanced prices of the present time) would yield a return of £ 18. 15s. or 187½ rupees, per acre:—this, it must be taken into consideration, is for the first year only, and there is every reason to expect a much larger return progressively for 10 or 12 years at the lowest computation of its capability of producing, as several trees scattered about here in Malay Campongs are said to be from 5 to 10 years old. Little credence can be placed in any native accounts of age, but it is, from its arborescent form and general characteristics, fair to assume that their ages are not over, but rather underrated. In most cases these trees are not attended to; the cotton is sometimes picked when wanted, but more frequently left to fall on the ground. If, with this inattention to its proper care, the trees will produce from 200 or 300 bolls of cotton after the 2nd or 3rd year, and continue to increase in their supply, is it not fair to infer that, with proper cultivation and a liberal supply of suitable manure, the yield will be in a much greater proportion?

From the number of matured bolls giving the weight before stated, it will not be an exaggerated supposition, but rather an under-rated one, to fix the increase at 200 per cent

in the second season as over the first; this would be at a decreased cost, as the land would be prepared for the first crop and less than half the cost would have to be encountered in subsequent years, (excepting that of picking which would not unwillingly be borne.) A small muster of this cotton is sent marked No. 1.——

The next seed tried here, of which I will now give an account of its produce, was the Egyptian seed sent from Bombay. This seed from some cause, its careless selection, the ill attention it had received during its transit, or from careless picking, or more probably I think from its age, was of a deteriorated character, and would have very likely given an unfavorable impression to a person seeing the first results of it. When planted very little appeared, and of the few that did there were not many healthy signs among them. Whether the first portion selected for planting was preeminently a bad lot taken by chance, or it was under some occult influence which evaded my observation, I cannot say; but upon further trials I found that a minority of the seeds was sound, and that, by planting rather more than twice the usual number, a fair stand could be obtained, but entailing the time lost in careful thinning in some places and the replanting in others, when, if by chance the seeds deposited were barren, it would fail to make any sign. I applied the test used by some planters, though not with much faith in its infallibility, viz. that of throwing the seeds into water and only using those that sank, rejecting the others. I can give in my adherence to the general principle, but not to it as a certain sign. Out of an accurate number of seeds planted, each the same number, to test the value of the rule, I found there was a failure of 27 per Cent in those that sank, and a fertility in those that did not amounting to 21 per Cent. I point this out as others may have tried it; and not knowing any definite result before my own trial, from its frequency of repetition in the works of merely theoretical writers upon the subject, and the confidence

with which they speak of it as an infallible test, I give the result of my experiments; and can only express the wish that this or some other certain mode of separating the good from the bad was known, as after the most careful scrutiny of the seed, ugly gaps will come here and there from the want of this desideratum. After this degression which though of apparently minor importance involves an important feature in cultivation, I will proceed to shew the result of the planting of seed. The first was planted at the end of August, bloomed through the month of November, matured in December, running to the end of January; successional plots were planted in following months, for the purpose of proving each respective month as stated under the head of "Time &c. of planting." That of the following month, that of September, was in its results identical with that of the former, so it will require no further notice. The planting of the end of October came to maturity during January and February of this year, and from the success attending it I should be strongly induced to make it the season, or one of the seasons, for the regular crop. In the planting of the following month, the end of November and beginning of December, and which is now yielding, but the prospect of its return is much less favorable than the preceeding month, during the first week of March no rain fell, but since then a succession of heavy squalls of wind and rain have prevailed and are said to be characteristics of the next months; this last planting also it will be observed has been longer in reaching maturity than the former ones, which I attribute in a great degree to its being retarded in its first stage through a continuance of dry weather, which last year prevailed during the first part of December to an unusual extent. Beyond this I can give no results as the plants are too young for any report to be made upon them, and the seed has been regularly planted more with a view of testing the adaptability of each month for planting, in conjunction with those of the following month, than for any other object. The general appearance

of the plants of the two following months, viz January and February, is, as far as I can judge, confirmatory of the value of the resolution not to plant in them. The seed had the same causes operating against it, only in a more prolonged degree, and the plants have the same appearances as those of the December planting at the same period of its growth. As the time fixed upon for planting was the middle and end of March, so that the blooms might come into the first part of June, which with the whole of July and the early part of August is the driest season here, I can only state that a considerable portion of the land is planted and the rest is being done as fast as more land can be fully prepared.

I will now proceed to give an account of the produce of this seed. From the yield of it, (this was from the end of October planting) a return of 1425 lbs. per acre of seed cotton was obtained; this when ginned gave a net return of clean cotton of 428 lbs, which is rather less than the third of the gross produce; this, at an estimate of $12d = \frac{1}{2}$ rupee per lb, will produce £ 21 s. 8, or 214 rupees per acre.—A muster of this will be found marked No. 2—

It now remains to speak of the third mentioned seed, the Egyptian sent direct, known as the “Maho.” This seed was planted for to prove it, and it fully realizes the expectations formed of it from the account sent of its yield and quality. I quote from a letter accompanying the seed. “Maho is yielding on an average $2\frac{1}{2}$ Cwt of ginned cotton per acre, but so much depends upon the careful cultivation, and *watering* in this dry country, (not a drop of rain falls during the whole time of growth of the plant) that the yield is differing very much, indeed from one field to another; under careful management the seed which we forward you yields 6 to 8 Cwt of ginned cotton per acre.”

Of the quality of the cotton you will be able to judge, and its yield is very superior to that from the other Egyptian seed received via Bombay, which from its unknown antecedents

may have become deteriorated on its passage or have been originally bad. I cannot speak with the same confidence of the *positive* return from this sort, but feel assured that, in stating it will exceed the other from the Egyptian seed by one fourth, I shall not exceed the most sober computation. I estimate its value at 2d. per lb more than the other, and allowing its produce to be only one eighth part more, the return from this will be equal to 1603 lbs, which at 14d. or $\frac{7}{12}$ of a rupee per lb for 481 lbs of ginned cotton, will give £ 28. 1s = 280½ rupces per acre. The whole of the estate here has been planted with this seed as far as it would go, and the stand it makes is highly satisfactory; the plant appears from 3 to 4 days after planting the seed, and in the course of 3 to 4 weeks the plants are ready for working; the fine healthy appearance and good stand of the plants is very encouraging. I think if a later period had been assigned for receiving the Essay I could have given more satisfactory results than I have been here able to do. From the circumstances of the case, I have been obliged, in this particular instance, to give an average from a smaller field of observation than I could have wished, and have, in consequence, considerably underrated the product in mine own opinion, rather than err on the other side. A muster of this is sent marked No. 3.

Quality and Value.

From the samples sent you will be able to judge of the quality and value of the cottons being grown here, and to form an opinion of the correctness of the estimates made; upon this much depends, and I have endeavoured to give them their proper value as far as I can form a judgment from prices quoted in England. I perceive the prices paid in the Liverpool cotton market on Feby. 8th were for,

Pernambuco from	12¾d. @	14½d. per lb
and for fair & good fair	13¾d. @	14d. „
and for Egyptian from	10¾d. @	20d. „
for fair and good fair	13 d. @	14d. „

These quotations are superior in value, to the assumed values placed against the cottons of a like kind, and should the above prices be realized would give a handsome-bonus to the adventurers.

A sample of No. 2 cotton has been sent to Liverpool, for to test its value; one to Manchester to obtain an opinion upon its character. I may also mention here that a small case of this cotton has been forwarded to the Exhibition in London of this year, through the agency of the Resident Councillor here, who with others of the Government are anxious for the development of a new field for the industry and welfare of the country.

Cost and Return.

I now proceed to the most important feature presented to notice in an undertaking of this kind, namely, does it pay, and I will endeavour to place before you as clear a statement as I can, both of the cost and return actually made and in expectation. The sum considered to be sufficient to test the capabilities of this place, as a new field for the culture of cotton, is \$ 5000 dollars or 11,250 rupees, but is not limited to that sum. (The dollar is calculated to be of the value of 4s. 6d. and the rupee at 2s. in all estimates made throughout)—The land has been granted free of cost for the time required for the trial; and independent of the small sums expended, upon the purchase of squatters rights, who were in several places on ground required for culture, or whose proximity was unpleasant, no charge has fallen upon the estate on this account. The inspection of land in every part where it appeared suitable was a cause of expense, and though not a large item, is only chargeable to this year's cost, and must be so considered, with wages, manure, seed, petty expenses, &c, under the same category; while the expenditure upon the building a hunga-ow, furniture and utensils, Overseer's house, coolies houses, manure sheds, Implements, Horses &c. amounting to about

20 per cent of the whole expenditure, cannot be charged as cost against one year as cost, the only one for several when the great portion of these charges can occur. Allowing the whole sum of \$ 5000 dollars, = 11,250 rupees, is expended, and admitting \$ 1000 dollars, = 2,250 rupees, for the expenditure on stock, plant &c, to be carried forward for distribution in a future time, there would remain a cost of \$ 4000, dollars, = 9,000 rupees, for the year, against a return of \$ 1,223, = 12,230 rupees, obtainable from the following estimate, viz.

	Acres of Pernambuco,	£	s.		Rupees pr. acre
	No. 1 @	18.	15	-	187½ „
20	„ „ Egyptian,				
	No. 2 @	21.	8	=	214 „
25	„ „ Do. "Maho"				
	No. 3 @	28.	1	=	280½ „

This would give a return of £ 1,223 = 12,230 rupees, viz.					
from No. 1	£	93· 15	=	937½	Rs.
„ „ 2	£	428	=	4280	„
„ „ 3	£	701· 5	=	7012½	„

£. 1,223	12,230	Rs.
This against an expenditure of	9,000	„
<hr/>		
would leave a balance of	3,230	„
<hr/>		

Subject to the charges of Freight, Insurances &c.

Concluding remarks.

I have endeavoured to place before you a statement of an experiment, to test the capabilities of an untried place for the culture of cotton, in as clear and candid a manner as I can; and I must here observe that I have not obtained information from books or papers, except some furnished me by the Deputy Resident-Councillor here, and which relate only to the

statistics regarding climate, population, rain fall, &c; and with regard to the published accounts of travellers, and often of residents, I am sorry to say facts are not truly described, and the most attractive features are only presented: thus in land, the best is only described; it is said to be a place unrivalled in its fertility, but no mention is made of the large tracts of comparatively useless soil: and in the equally important item of labour, it is stated to be obtainable at always the minimum price, and the inference naturally is that it can be commanded; now this is not true; I can most positively assert that in the many places I have visited, without any exception labour is not to be obtained at the price stated by the writers. But this is not the greatest wrong to the new settler; it is not fairly stated that this labour is generally very restricted, (of this the writer should make himself acquainted) but it is left to the experimentalists to find, that even an increase of the nominal wages will not induce labour to come in as a certainty, from the causes I have stated under the head of "Labour." This in my opinion should be fairly and unequivocally placed before the public, and should be a guide to the adventurer, and not, as it now too often is, only a lure to tempt him to a region where experience will soon shew him how fallacious his hopes were, if placed only upon the prospects held out to him by partisans. That this trial of an untried place as a new field for cotton culture was made with a hope of its pecuniary success, may appear a superfluous remark; but at the same time, it was not intended to be, and will not be, abandoned until a complete trial of its capabilities has been made; this I think will not result in any other way than success when it is borne in mind the extra expense of forming a new plantation, breaking virgin soil, raising houses, &c. the purchase of Implements, not at first in the best market, and the great difficulty overcome of being able to obtain labour in greater quantities and at a lower price, from an acquaintance with the means of proceeding unknown to the new

comer, for which he has to pay a certain sum which all experience is said to cost. From the foregoing statement of Cost and Return, though not one presenting so favourable a face as could be wished, it is considered so promising by the projectors of this experiment, that the culture for the future will be extended to the obtaining suitable land here, knowing well that the already cultivated land will be available at less than one half the cost of this year; and at the same time will be more productive, and the new less costly in preparing, from the experience gained during this probational term. I think the Egyptian seed has here a strong disposition to become perennial; for from the stems of plants left standing on the ground after they have produced all their cotton, and the leaves have put forth, and the most of the old plants are as vigorous in appearance as the plants of 2 to 2½ months old. Whether this would be a boon, should it be realized, or only a temptation to allow a longer existence without a commensurate return, I know not; but am inclined to think the best course to pursue would be to make a sacrifice of all second growth; and, instead of turning aside to pursue the possible future keep the safe and certain course. It is worth proving, and for this purpose, I have kept a plot of some plants about 6 months old, to ascertain the fact, and if so the comparative return.

With regard to insects, and the ravages made by them upon the cotton I have not adverted to before, I will now state that the most destructive one here is a species of *cunex*, generally found in pairs, one on the back of the other, of a bright metallic hue; this injures the leaf after it has become from 1 to 2 months of age, but not to a serious extent: then there is a red fly of small size, which appears when the boll has opened, and is to be found in it, but no injurious effects have been traced to it: the black caterpillar has also been occasionally found, but so scarcely as to give no solicitude on its account.

In an early stage of the planting here a small quantity of seed, (Egyptian), was forwarded to me by Col. Cavenagh, the Governor of the Straits; he had it from Calcutta; it was good sound seed, but the quantity was so small it could not enter into my report of the plantation; the quality of the cotton was good, a sample of which was sent to his Honor.

This enterprise was commenced and has had to be carried through several difficulties; but from its success it promises well for the future, and I doubt not will form one of those places, from whence a sure, a certain, and an ample supply of cotton can be obtained, which is so necessary to the industry and welfare of the mother country.

WASHINGTON ESTATE:

Province Wellesley.

CHARLES MADDOX.

Observations on the Assam Tea plant, with an abstract of the reduction of Meteorological Registers in Upper Assam. By G. W. MASTERS, ESQ.

“Chemical analysis has not yet discovered that principle in tea, to which its exciting property is due.” *Ure* 1839.

“Tea exhilarates without sensibly intoxicating. It excites the brain to increased activity, and produces wakefulness.

In manufactured tea there are at least three active chemical substances, by the conjoined influence of which these effects are produced.

1. *The volatile oil.* A hundred pounds of Tea yield about one pound of this oil, and to this minute quantity of its volatile ingredient the value of tea in general estimation is in a great measure due. Its special action upon the system has not yet, we believe, been scientifically investigated.

2. *The Theine.*—Theine has no smell, and only a slightly bitter taste. It has little to do therefore either with the taste or flavour of the tea from which it is extracted.—An ounce of good tea contains about ten grains of theine.

3. *The Tannin* or tannic acid.—To this tannic acid tea owes its astringent taste, its constipating effect upon the bowels, and its property of giving an *inky* infusion with water which contains iron. It forms from 13 to 18 per cwt. of the whole weight of the dried tea-leaf, and is the more completely extracted the longer the tea is infused.

4. *The Gluten*.—The three substances already described may be considered as the really active constituents of the tea-leaf as it is usually employed. But it is an interesting fact, that the leaf contains a large proportion of that nutritive ingredient of plants to which the name of gluten is given. This substance forms as much as one-fourth of the weight of the dry leaves; so that if we chose to eat them in mass, they would prove as nutritious as beans or peas." *Johnston's chemistry of Common life*, 1859.

On the cultivation of the Tea plant.

Leaves constitute the most important part of the Tea shrub, and to afford free uninterrupted respiration to the leaves is the most important object to be attained in its cultivation. "Respiration takes place by the power the leaves possess of inspiring and expiring oxygen, and decomposing carbonic acid." *Lindley*, 1832.

"The decomposition of the carbonic acid absorbed from the air is effected in the parenchyma of the leaves, as well as in all other green and herbaceous parts of the vegetable. When exposed to the action of the sun, they decompose that gas, detain its carbon, and disengage the oxygen. The reverse takes place when they are withdrawn from the influence of light, in which case they extract from the air a portion of its oxygen, which they replace by disengaging an equal quantity of carbonic acid gas." *Richard. Translated* 1831.

"The quantity of carbonic acid decomposed, is in proportion to the intensity of the light which strikes a leaf, the smallest amount being in shady places, and the healthiness of

a plant is, *cæteris paribus* in proportion to the quantity of carbonic acid decomposed ; therefore the healthiness of a plant should be in proportion to the quantity of light it receives by day." *Lindley 1840.*

These principles are to their utmost extent applicable to the Tea-plant, which, when firmly established in a suitable soil, and enjoying the benefit of good cultivation, is most luxuriant, and produces the most healthy leaves in full sun-light.

Whether the Tea-plant found growing wild in Assam, is, or is not, identical with the wild Tea-plant of China ; or whether the several varieties now cultivated in Assam are, or are not, identical with the numerous varieties cultivated in China, appear to me to be questions of no importance whatever to the planter : although the identical species originally described by Kœmpfer, and by Linnæus, more than a hundred years ago, may possibly exist in some European Gardens, yet, I very much doubt its existence in China, as an unaltered plant. Nor can it be of the slightest importance to the planter ; whether the Tea-plant was brought from China to Assam, or carried from Assam to China ; both equally improbable, equally unnecessary both. The Tea-plant is quite likely to be indigenous to Assam, as are the plants noted in the following list, all of which are common to both countries.

Plants common to China and to Assam.

Ruellia carnosæ Wall.

Thalictrum bracteatum Roxb.

Ranunculus Sceleratus Linn.

Viola Patrinii Dec.

Hypericum Japonicum Thunb.

Urtica nivea Linn.

Houttuynia cordata Thunb.

Murraya exotica Linn.

Naravelia Zeylanica Dec.

Nelumbium speciosum Willd.

Parderia foetida Roxb.

Musa coccinia Andr.

Nandina domestica Thunb.

Fragaria Indica Andr.

Urrea lobata Linn.

Niphobolus pertusus Roxb.

Ficus nitidus Thunb.

Pierardia sapida Roxb.

Some of these range from Goalparah to the Brahmakoond, in the plains and on the hills: two hundred species more might be added to the list.

I shall now endeavour to describe those varieties of the Tea-plant, which appear to be the most desirable to cultivate for the manufacture of Tea: adding a few hints relative to the description of soil best adapted to each variety; the most approved method of cultivation; and so far as practicable, the most approved mode of manipulation or manufacture of Tea.

The general character of the Tea-plant as found in Assam here follows.

Small trees. Bark smooth, wood of close, fine grain, Leaves alternate, exstipulate, short-petioled, lanceolate, oblong, or elliptic, occasionally obovate, tapering, emarginate, smooth above, downy or silky underneath, undulate, serrated, sprinkled with minute pellucid dots, serratures ending in sharp black points, lateral veins anastomosing in a waved line within the margin. Flowers axillary, solitary, or several together, on short bracteated peduncles, white, often fragrant. Sepals 5, small, imbricated, persistent; the exterior three more or less united at the base; the interior two, somewhat larger, scarcely equal. Petals about 6, concave, imbricated, often membranous, or ciliate at the margin; the exterior two green at the back, or sepal-like; interior four white, attached to the staminiferous tube, and with it deciduous. Stamens numerous, filaments united at the base, anthers 2-lobed. Ovarium superior; downy, silky, or

pubescent, furrowed, 3-celled, with 4 ovules in each cell; style downy, or silky, somewhat 3-sided, 3-cleft above the middle. capsule loculicidal, 3-lobed, or 2-lobed, or globose, with as many cells as lobes; cells one or 2-seeded.

There appear to be two varieties of the Assam plant: one, with a dark, firm, lanceolate leaf, variously sprinkled with pellucid dots; the other with a pale, thin, ovate leaf, very minutely dotted. The first is undoubtedly the best, containing as I believe more gluten, and exhibiting larger and more conspicuous pellucid dots: receptacles of volatile oil? It may for the most part be easily distinguished by the following character.

1 Leaves usually distant, somewhat of a dark colour, large, smooth, firm, oblong, ovate, lanceolate, or elliptic, sometimes obovate, more or less tapering to a fine, a blunt, or emarginate point, often oblique; variously sprinkled with pellucid dots: usually minutely dotted over the whole surface, and sprinkled with larger dots, the large dots occasionally appear in clusters. The lateral veins frequently run on nearly to the margin before they anastomose, and without forming that distant, conspicuous waved line, so common in the 2nd variety. This latter character, however, is not constant, as the leaves are sometimes waved, and in a good soil, and under good cultivation, the two varieties run much into each other. An examination of the following dried specimens, gathered in 16 different Gardens will enable any one to recognise the plant.

- No. 1.—a Mr. Paul's Garden, Golaghat.
 „ 2.—a Mr. Williamson, Bôngmakhua.
 „ 3.—a Jorehant Company, Outing.
 „ 4.—a Mr. Spear's, Nanghtope.
 „ 14.—a Jorehant Company, Cinnamara.
 „ 16.—b Assam Company, Ligripookuri.
 „ 17.—g Do. Mazanga.
 „ 22.—a Do. Chiricdea.

- No. 26.—*a* Colonel Hannay, Dibröo.
 „ 29.—*a* and *c* Mr. Wagentreiber, Nagagooli.
 „ 31.—*d* and *h* M. J. Jenkins, Chulkwah.
 „ 37.—*a-f* Assam Company, Kahung.
 „ 38.—*a-b* Do. Nahaliah.
 „ 39.—*a* Do. Kato.
 „ 40.—*a* Do. Tippum.
 „ 41.—*a* Do. Hookumjury.

2. Leaves large, pale, thin, waved, ovate, or broadly lanceolate, more or less tapering to a fine, a blunt or emarginate point, often oblique, sometimes rounded at the base, minutely dotted: the lateral veins usually anastomosing at a distance from the margin, and there forming a conspicuous, waved line.

The following specimens are examples.

- No. 6.—*a-b* East India Company, Duphlatung.
 „ 11.—*a* Jorehaut Company, Numalighur.
 „ 16.—*a* Assam Company, Ligripookuri.
 „ 31.—*a* Mr. J. Jenkins, Chulkwah.
 „ 40.—*b-c* Assam Company, Tippum.

Of the China plant there appear to be numerous varieties, varying greatly in size, shape, and texture.

Leaves coriaceous, usually small, often crowded, lanceolate, ovate, elliptic, orbicular, rotund, or obovate; sometimes stemclasping; obtuse, or tapering to an emarginate point, occasionally oblique, and unequally divided by the midrib: minutely, copiously, or variously sprinkled with pellucid dots, now and then altogether without dots.

The following specimens are examples.

- No. 1.—*c-d* Mr. Paul, Golaghat.
 „ 2.—*c* Mr. Williamson, Bongmakhua.
 „ 3.—*c* Jorehaut Company, Oating.
 „ 4.—*f-h* Mr. Spears, Nungletope.
 „ 5.—*f* Mr. Williamson, Sokryting.
 „ 6.—*d-e* East India Company, Duphlatung.
 „ 7.—*d* Mr. Spears, at the Nambur.

- No. 9.—*e* Mr. Stewart, Lettikoojan.
 „ 13.—*d-f* Mr. Spears, Niggeriting.
 „ 14.—*b-p* Jorehant Company, Cinnemara.
 „ 15.—*e-g* Assam Company, Nazerah.
 „ 16.—*f* and *k* Do. Lignipookuri.
 „ 17.—*h* Do. Mazanga.
 „ 18.—*a-i* Assam company, Mazanga.
 „ 21.—*e-f* Do. Deopany.
 „ 22.—*f-k* Do. Chericdeo.
 „ 23.—*c* Mr. Thornton, Seeksagur.
 „ 25.—*b* From various Gardens.
 „ 26.—*c* Colonel Hannay, Dibroo.
 „ 27.—*c* Messrs Melaney, Borpothar.
 „ 28.—*c* Revd. E. H. Higgs, Dibrooghur.
 „ 29.—*d* Mr. Wagentreiber, Nagagoola.
 „ 32.—*c* Captain Comber, Dibrooghur.
 „ 33.—*c* and *a* Assam Company, Tingrimookh.
 „ 34.—*a-g* Do. Do. Do.
 „ 36.—*b* Old Government Garden, Chubwah.
 „ 40.—*d-c* Assam Company Tippum.
 „ 41.—*b* Do. Hookumjury.
 „ 42.—*b* Do. Towrok.

The Tea soil in upper Assam varies considerably, but existing chiefly as a soft, yellowish, brownish, or reddish clay, the silex, alumina, and oxide of iron being in a state of almost impalpable powder, with scarcely a trace of lime, and very little vegetable or animal matter, except at the very surface.

The following specimens are examples.

- No. 1. Grass lands at Golaghat.
 „ 2. Mr. Paul's Tea garden at Golaghat.
 „ 4. Jorehant Company, Oating.
 „ 5. Mr. Spears at the Nambur.
 „ 7. Jorehaut Company, Numalighur.
 „ 8. Mr. Williamson, Diphloo.

- No. 11. Assam company Mazanga.
 „ 15. „ Do. Chericleo.
 „ 17. „ Do. Deopany.
 „ 20. Revd. E H. Higgs, Kemikur.
 „ 25 Assam company, Kahung.
 „ 26 Do. Naholiah.
 „ 27 Do. Kato.
 „ 29 Do. Tippum.
 „ 34 Do. Hookimjury.

The China Tea plant, and the first variety of the Assam plant, often called “Hybrid,” when under good cultivation, appear to thrive equally well in either of the above mentioned soils; and they even grow freely in soils that are far inferior, such as,

No. 10 Assam Company’s Nazerah station.

- „ 19 Revd. E. H. Higgs Rheah Garden, Dibrooghur.
 „ 31 Assam company, Tingrimookh.

The second variety of the Assam plant does not appear to thrive in the inferior soils, when exposed to the full influence of the sun: however, I am not prepared to say that it will not flourish without shade: I have not yet seen a Tea garden which has been for ten years under positively good cultivation; and when examining the plants at Mazanga, and in other gardens of the Nazerah Division, I found difficulty in distinguishing one variety from the other without a good lens. I find the same difficulty among plants in a newly formed Garden, that is, actually cultivated.

At Tippum, where I gathered the specimens No. 40—b—c, the soil is the same, No. 28, and the plants from which specimens were gathered are growing within a few yards of each other, even this, in my opinion, does not settle the question regarding shade and sun: although Tippum has been a Tea-Garden for twenty four years, still, the ground has never been properly cultivated.

In a Tea-Garden I would recommend partial shade; scat-

tered trees, with at least thirty feet of clear stem, without branches: when forest land is cleared for a Tea-Garden, a few straight stemmed, tall trees can be selected, and allowed to remain for the purpose of affording shade: when grass land is taken, or land altogether without trees; if the ground is properly prepared, and the seed regularly sown in rows, a few of the strongest, straightest young Tea-plants may be selected, (not more than four per cent,) and allowed to form standards, or half-standards; their leaves never to be pricked till they have grown to the desired height, when these standard tea-trees will afford all the shade required, and produce some seed.

The following are some of the leading indigenous plants usually found growing in the best Tea-soils.

Mesua ferrea, Liquidamber cerassifolia,
 Aralia species, Gordonia integrifolia,
 Aquilaria Agallocha, Premna species,
 Artocarpus chaplosa, Gmelina arborea,
 Laurus porruta, Bignonia chelonoides,
 Lagerstroemia Reginai, Castania species,
 Cedrela Toona, Dipterocarpus lavis,
 Michelia species, Mangifera sylvatica,
 Pierardia sapida, Emblica officinalis,
 Gyrocarpus species, Andrachne trifoliata,
 Cinnamomum species, Callicarpa 3 species.
 Sambucus species, Styrax simulata,
 Urtica crenulata, Melastoma Malabathricum,
 Osbeckia angustifolia, Osbeckia Wightiana,
 Clerodendrum nutans, Alysicarpus species.
 Hedyotis scandens, Rubus roseifolius,
 Thumbergia coccinea, Morinda scandens?
 Exacum tetragonum, Eranthrinum pulchellum.
 Torenia pians, T. racemosa, commelyna nudiflora.
 Imperata cylindrica, Anthisteria arundolana,
 Panicum several species, Paspalum species,

Poa species, *Melica latifolia*, *melica retrofracta*,
Saccharum 2 species, *Chloris* species.

Hilminthostachys dulcis, *Lygodium microphyllum*,

When forming new plantations in Assam the following hints may be found useful.

Having procured a Grant of Land suitable to Tea cultivation :

1. Select a proper site for a dwelling house, Tea-house, and other buildings.

2. From the site of the buildings set out and open a main road, running right through the forest.

3. Mark out the boundaries of the intended Tea-Garden.

4. Make a good fence all round the intended Garden before the forest is cut down.

5. Mark the trees, and other plants that are to remain ; cut down, and root up, every thing else. .

6. Set out, and make convenient cross-roads, and walks leading to every part of the Garden, and, when practicable, let them be at right angles to the main road.

7. Dig all the ground between the cross-walks ; dig it well, and in a deep soil, or where practicable, trench it, levelling the surface.

8. Set out straight lines, five feet distant from each other, to receive the Tea-seed, the first line to be parallel to, and two feet six inches from, the cross-walk.

9. Sow single seeds five feet distant from each other in the rows : a single seed produces the most healthy, handsome, bushy, productive plant.

10. China seed may be sown much thicker, four feet, or three feet distant from each other ; it may be sown at the distance of one foot only, in four-feet wide beds, with a path two feet wide between the beds.

Manufacture.

The method of making Black Tea, has been fully described

by Mr. C. A. Bruce, whose Report was published in the Agricultural Society's Transactions in 1840 and to which I have seen nothing superior on the subject. For the following hints I am chiefly indebted to Messrs C. A. Bruce, J. Jenkins, and George Williamson Senr.

In the first place the youngest, and most tender leaves only, are so gathered; and if practicable, the picking on each day should be completed by eleven (11) A. M. as, up to that hour, the leaves and young shoots remain brittle, and are easily severed from the tree; but after that time, through the influence of the sun, the foot stalks of the leaves, and the young shoots become tough, and are not so easily separated: in fact it not unfrequently happens that the leaf pluckers tear off the whole of the young shoot, thereby injuring the plant, and at the same time furnishing leaves which are unfit for the manufacture of Tea: the most approved method is to pick off the terminal bud, together with the last expanded leaf, in the first instance, and to gather the coarser, or souchong leaves in a separate basket: keeping the young leaves, and the old leaves separate from each other, is, I conceive, an essential point, as the older leaves require more heat, more frying than do the young, tender leaves, and unexpanded buds.

When the leaves are brought into the tea-house, let them be spread thinly out on bamboo trays: and withered in the sun, or in the withering house: to ascertain when they are sufficiently withered, take up a handful of the leaves: if they will bear pressure without snapping: if the stalk of the leaf is pliable, and will admit of being bent double without breaking, the leaves are withered enough, and should be set by half an hour to cool: in the absence of sun shine, or of a withering house, the fresh spread gathered leaves, being thinly spread on the trays, may be put by on shelves to wither during the night.

In the morning, or when the leaves are cool, deal out about four pounds of the green leaves to each Tea-maker, who

should stand up with the leaves before him in a tray, placed on the Tea-table, and endeavor to soften them still more by gently rolling, beating, pressing, tossing up and separating the leaves, and again rolling, beating, pressing and tossing up, till the leaves become to the touch like soft leather: in this state throw the leaves thickly even to the depth of eight or nine inches, in large deep trays, and cover them over with cloth, in order to promote fermentation, and to secure the aroma.

When the leaves have become warm, and the older ones begin to assume a reddish colour, let about two pounds be put into a good bright red-hot cast iron pan, and briskly moved forward and backward, tossed up, and again let fall into the pan, performing the operation with a bamboo fork when the leaves become too hot for the hands: when the leaves steam well, let them be taken out, and well-rolled on the table, frequently shaken, and separated to prevent their balling; this last operation should be repeated, two or three times: the leaves being thus well rolled, and twisted, let them be put by till several maunds are collected together, when the second frying may be given in a cooler pan, which will not require the use of bamboo forks, but the same rolling, shaking and separating as before; this done, the leaves should at once be put over the charcoal fire; about four pounds of leaves being put into each drying basket, carefully watched, and continually turned till perfectly dry: when perfectly dry the leaves have become Tea, and should immediately be put into boxes or store-boxes to preserve the aroma. Previous to final packing for exportation, the Tea should again be placed over the charcoal fire in the drying basket for thirty-six (36) hours. Supposing all the operations to have been carefully performed, no old, sickly, or damaged leaf introduced, and the tea to be now, perfectly dry when put into the lead-lined boxes, it may be considered to be in its highest state of perfection; it contains all the aroma, all its astringent, exciting, and nutritious properties, and whatever else may be done to it in

this country, under existing circumstances, can only tend to diminish its value.

J. W. MASTERS.

GOWAHATY : .

21st March, 1863.

Abstract of the reduction of meteorological Registers kept in upper Assam during the last twenty three years. 1840-1862.

January.—In this month the weather is generally fair : there are dense fogs in the morning, and the sky is frequently overcast with light clouds, or hazy in the middle of the day : evenings clear : occasional thunder showers : more rarely no rain at all.

Fall of rain from 1 to 4 inches.

Mean temperature of the day = 61.49.

Do. Do. of the night = 59.89.

Do. Do. of the month = 60.05.

Do. Do. on the 15th = 62.27.

Highest temperature observed in perfect shade = 76.°

Lowest Do. in 1860 Nambur banks = 36.

Greatest variation, = 40°

February.—There is generally fair weather in some portion of the month of February, though not invariably so : dense fogs in the morning are frequent, as are thunder showers at night : it occasionally turns out to be a dull, cloudy, misty, hazy, unpleasant month, without a single fine, clear day : more rarely no rain at all.

Fall of rain from 1 to 4 inches.

Mean Temperature of the day = 65.80.°

Do. Do. of the night = 64.06.

Do. Do. of the month = 64.63.

Do. Do. on the 15th = 63.72.

Highest temperature observed in perfect shade = 81°

Lowest temperature Do. = 46°

Greatest variation, ± 35°

March.—March is generally a very stormy, rainy, month, with occasional intervals of fair weather: usually, there is comparatively little rain during the day, but periodic thunder showers at night and frequent hail storms; mornings and evenings fair: occasionally the sky is overcast with thick haze throughout the month, with scarcely a drop of rain; this was strongly confirmed in 1851, 1853 and 1863.

Fall of rain from 0 to 11 inches.

Mean temperature of the day = 70.27.°

Do. Do. of the night = 68.44.

Do. Do. of the month = 69.35.

Do. Do. on the 15th = 70.33.

Highest temperature observed in perfect shade = 90.°

Lowest Do. Do. = 48.

Greatest variation, = 42.°

April.—Weather changeable, generally very rainy and stormy: periodic thunder showers at night, which occur for 10 or 12 nights successively, commencing later and later, till they fall in the morning: however, there are occasional intervals of beautifully clear weather.

Fall of rain from 5 to 17 inches.

Mean temperature of the day, = 76.00.°

Do. Do. of the night = 72.92.°

Do. Do. of the month = 74.56.

Do. Do. on the 15th = 75.24.

Highest temperature observed in perfect shade = 91.°

Lowest Do. Do. = 60.°

Greatest variation, = 31.°

May.—Weather changeable as in April: often very rainy and stormy: periodic thunder showers: occasional intervals of fair weather.

Fall of rain from 3 to 16 inches.

Mean temperature of the day = 78.63.°

Do. Do. of the night = 77.03.

Mean temperature of the month = 77.83.

Do. Do. on the 15th = 76.00.

Highest temperature observed in perfect shade = 94.°

Lowest Do. Do. ... = 66.°

Greatest variation, ... = 28.°

June,—June is very rainy, stormy generally, with frequent thunder showers at night: the sky is for the most part thickly overcast, but there are occasional intervals of fair weather.

Fall of rain from 9 to 19½ inches.

Mean temperature of the day = 81.72.°

Do. Do. of the night = 79.97.

Do. Do. of the month = 80.85.

Do. Do. on the 15th = 81.45.

Highest temperature observed in perfect shade = 92.°

Lowest Do. Do. ... = 70.°

Greatest variation, ... = 20.°

July,—Cloudy, and rainy generally, with frequent squalls, or heavy thunder showers at night: the sky overcast in the morning, but occasional intervals of beautifully clear weather in the afterpart of the day.

Fall of rain from 9 to 19 inches.

Mean temperature of the day = 82.52.°

Do. Do. of the night = 81.05.

Do. Do. of the month = 81.75.

Do. Do. on the 15th, = 81.05.

Highest temperature observed in perfect shade = 96.°

Lowest Do. Do. ... = 74.

Greatest variation, ... = 22.°

August,—Cloudy, rainy, or overcast in the morning generally: frequent heavy showers, followed by intervals of fair weather of a few hours duration: occasional thunder showers at night.

Fall of rain from 8 to 23 inches.

Mean temperature of the day = 83.67.°

Do. Do. of the night = 82.14.

Mean temperature of the month=82.90.

Do. Do. on the 15th=82.73.

Highest temperature observed in perfect shade=95.°

Lowest- Do. Do.=73.°

Greatest variation,=22.

September,—Dull, cloudy, rainy, oppressive weather generally, at the commencement: evenings frequently fair, and more settled weather towards the end of the month: occasional thunder storms.

Fall of rain from 8 to 19 inches.

Mean temperature of the day,=82.23.°

Do. Do. of the night=81.85.

Do. Do. of the month=81.69.

Do. Do. on the 15th=80.95.

Highest temperature observed in perfect shade=92.°

Lowest Do. Do.=71.

Greatest variation,=21.

October,—Weather changeable: morning cloudy, or foggy, with frequent showers at the beginning: fair weather generally towards the end: occasional thunder showers.

Fall of rain from 3 to 12 inches.

Mean temperature of the day=77.94.°

Do. Do. of the night=76.48.

Do. Do. of the month=77.27.

Do. Do. on the 15th=77.09.

Highest temperature observed in perfect shade=91.°

Lowest Do. Do.=63.

Greatest variation,=28.

November,—Weather generally fair: mornings often foggy: occasional showers, and sometimes thunder.

Fall of rain from 0 to 2 inches.

Mean temperature of the day=70.41°.

Do. Do. of the night=67.73.

Do. Do. of the month=68.89.

Do. Do. on the 15th=69.39.

Highest temperature observed in perfect shade=85°.

Lowest Do. Do. =52.

Greatest variation=33°.

December,—Weather generally fair: frequent dense fogs in the morning: occasional sprinkling of rain, and sometimes thunder.

Fall of rain from 0 to $1\frac{1}{2}$ inches.

Mean temperature of the day=62.06°.

Do. Do. of the night=60.36.

Do. Do. of the month=61.21,

Do. Do. on the 15th=61.41.

Highest temperature observed in perfect shade=79°.

Lowest Do. Do. =40.

Greatest variation=39°.

Average annual Rain fall 100 inches, *one hundred*.

Mean annual temperature=73°.

Highest temperature observed in perfect shade=96°.

Lowest Do. Do. =36.

Greatest variation=60°.

Maximum in the full sun=134°.

Extreme annual range in the open air=98°.

The above abstract of reductions has been obtained from my own uninterrupted register of 13 years. 1840—1852.

The Rev. E. H. Higgs' register of 12 years: 1851—1862.

Register of the Sub-Assistant Surgeon Seeksagoor. 1859—1862.

Register of Dr. Simons at Nazerah from 1860=1862.

Register of the late Dr. Long at Nazerah, Dibrooghur and Seeksagur from 1845 to 1850.

J. W. MASTERS.

GOWAHATTY:

23rd March, 1863.

*Notes on the Indian Bombycidae. By Capt. THOS. HUTTON,
H. M. Bengal Army.*

When, in a commercial point of view, we take into consideration the great value of Silk, its durability, and the great beauty of the fabrics manufactured from it, the advantages that must accrue to Silk Cultivators in possessing a clear knowledge of the various species which are indigenous to and scattered over this vast Empire, are so obvious, that, often as the subject has been handled, I feel assured of being excused both by the scientific and commercial world for attempting once more, however imperfectly, to dispel the darkness which still in some measure continues to envelope the subject, and often causes those who are uninitiated in the mysteries of Entomology, to confound and confuse, from some trivial resemblance, species that are totally distinct.

It must be borne in mind, however, by scientific readers, that I do not put forth this paper with any pretensions to correctness of classification, but simply with the intention of grouping the species as they appear to be naturally connected by habits, manners, and a general similarity in the larvæ and structure of the cocoons; much, I am aware, must in the present imperfect state of our knowledge, be left undetermined in respect to the arrangement, or succession, of the different genera, and a more scientific classification will, therefore, be reserved for consideration in a future and larger work should I find as I proceed in my present investigations that such is needed, and my present endeavour will, consequently, be confined to the ascertaining and grouping of what species we actually possess. Be it understood, therefore, that I have undertaken to draw up this series of Monographs rather with the view of eliciting information as to the species which actually are, or may be rendered, available as silk producers, than with the intention of writing a scientific treatise.

An attentive consideration of the differences observable in the quality of the Silk, in the larvæ, cocoons and imago of the various Indian species of the nocturnal Lepidoptera, which are included in the family of *Bombycidae*, or Silkworms, will unavoidably compel the close observer to perceive that they are very naturally divided into groups, each distinguished from the other by certain characteristic habits and manners; and he will likewise, soon be led to acknowledge the truth of a remark which, in a previous paper, I have already made in regard to the impossibility of properly classifying the species without an intimate knowledge of the various transformations which they undergo from the egg to maturity. It may not, indeed, always suit the theoretical views of the mere closet naturalist to admit the correctness of this remark, yet nevertheless, I trust to be able, from the facts which will be adduced in the following pages, to clearly prove that I have stated nothing but the sober truth, and that it belongs to the working, or field naturalist, to make known these characteristic traits and changes which the systematists of Europe have otherwise no means of ascertaining.

It is a curious fact that the species included in this family, which contains both some of the most beautiful, and the most useful species of the Insect world, are devoid of a mouth adapted for the reception of nourishment, although in the greater number it would appear to be sufficiently organised to enable the insect to secrete and eject a liquid possessing the property of dissolving the resinous gums with which the threads, or fibres of the cocoons are agglutinated. It would appear, therefore, to be well worth trying experiments, with a view to ascertaining the exact nature, or composition both of this solvent, and of the resins by which the threads are held together, in order that by the adoption of artificial means we may be enabled to unwind those cocoons which have hitherto proved intractable. In the Mulberry feeding Silkworms and some others, the substance appears to be a simple gum, melt-

ing readily in warm water, and rendering the reeling process easy of accomplishment; but in many of the larger kinds mere warm water has no effect, thus showing that the agglutinating substance partakes more of the nature of a resin, while yet even in this case, I have never been able to perceive that alcophol had the slightest effect upon it, besides that such solvent is calculated to injure and destroy the Silk itself.

It seems curious then that in this age of Chemical progress, no one should yet have experimented with a view to ascertain by analysis the nature of this agglutinating substance, for if once that were ascertained it would be easy to find a solvent for its removal. It is true that we have from time to time been told that such discovery had been made with regard to the Eria (*Attacus Ricini*), though the old method of carding is still continued.

In those species which have apparently no power to secrete a solvent, as for instance in the genus *Attacus* or Eria moths, arrangements have been made for facilitating the egress of the insects by leaving the threads at the head, or upper end of the cocoon unagglutinated, and only loosely drawn together or semi-closed, so as to be easily pushed aside by the head and forefeet;—but in the genera *Antheræa* and *Actias*, in which the cocoons are extremely hard and tough and without the least opening, the solvent from the mouth of the moth would, if unassisted by other means, be wholly insufficient to enable the insect to come forth, and these are consequently furnished in addition, with a strong sharp-pointed horny spine, or spur situated on the shoulder of each anterior wing, close to the *patagia* or tippets, where it is concealed by the long down, and with which the moistened mass of threads is then divided, and an orifice formed through which the moth is enabled to escape.

How difficult, not to say, how impossible it would be for the insects of these genera, if unarmed with the wing spur, to escape from the cocoon will be readily understood when I ex-

plain that the true silk yielding cocoon in the genus *Actias*, and also in *Antheraea Roylei*, is encased within another which is so tough and closely woven as to be impervious to water, and is partially glazed externally for the protection of the pupa from inclement weather; while in *Antheraea Paphia*, *Antheraea Frithi*, *Anth. Assama* and others of the true Tussur group, the threads are so massed and agglutinated as to render it impossible for the solvent to effect more than the dissolution of the gum. In order, then, to make its escape, the moth brings into play the wing spur with which nature has supplied it, and commences the separation of the threads by alternately working each wing, the point of the spine being frequently seen protruding through the silken mass as the work proceeds.—This is perhaps, one of the most striking and remarkable provisions of nature to be met with among the insects of this family. A good and well formed Tussur cocoon is so extremely hard and resisting, that it is difficult and often impossible by the strongest pressure of the fingers to make the least indentation in it, and indeed so hard and durable are those of *Anth. Paphia* that the natives are in the habit of using them when cut into transverse rings, for binding the barrels of their match locks to the stocks.

In the construction of the cocoons, and in the situations chosen by the caterpillars for their suspension, the observer will find abundant room for wonder and for admiration, so strongly and unmistakably is the guiding hand of a superior Intelligence displayed in these respects. In *Attacus* and *Antheraea*, the worms of which feed upon leaves that are deciduous, the larvæ when the spinning season arrives, exhibit what might be almost termed a wondrous foresight did we not know who was the real reasoner who prompted the insect's actions; we might indeed, almost imagine these larvæ to reason thus:—‘I am about to construct a cocoon for my winter residence previous to changing into a pupa; but before I can again change into a moth, these leaves among which I shall spin my silken house,

will fade and fall from the tree, and I shall thus become exposed to the risk of being trampled under foot, or of being devoured alive by Ants, or Rats, or other enemies.—To prevent this, therefore, I will begin by attaching to this slender twig, from which the leaves depend, a strong and durable rope of silk, which I will fasten at four or five inches from the end and then conduct along the stem to the leaves themselves, in one or more of which, after covering them with silk, I will spin my house. Then the leaves may fade, and the wintry storms may blow without endangering me, for my silken rope will remain secure and firm even though every leaf be blown away.”

In *Actias* there is no such safety rope, but, which serves the same purpose, the cocoon is closely and strongly fastened against a thick twig, or the stem of the shrub or tree upon which it may have been nourished ; while so far is this reasoning carried, that those species which are double brooded, and which spin no rope, will avoid feeding, in the second brood, upon those trees and shrubs whose leaves are subject to the Autumnal fall, and will select instead some other food where the risk is not incurred, and whose leaves will at least remain firm and safe until after the moths have issued from the cocoons ; these will then deposit their eggs upon the bark, where they remain attached till the spring returns. The instinct in this case is shown by the moths of the first brood, which avoid deciduous trees whereon to lay their eggs.

It has been stated with a view to account for the apparent rarity of some species of this family, that—“ in the gloominess of their dispositions, they seek the obscurity of the forest in the day, and only venture on the wing when the sun is down. In Europe we visit their nocturnal haunts without difficulty, or dread ; but in hotter climates these are oftentimes impenetrable, or the lurking places of ferocious animals ; and few will expose themselves to their attacks to increase the Catalogue of Exotic Moths.”—(Drury’s “ Insects of China.”)

Small blame to the man, say I, who declines the task of catching the flies that are buzzing around the jaws of a Tiger, or other ferocious brute; but the views here set forth are scarcely to be regarded as correct; and I venture to assert that no one who has paid attention to the habits of this tribe in their native haunts, would ever think of penetrating into the deep and gloomy recesses of a tangled forest in search of specimens of the larger Moths, since a very small amount of observation will suffice to convince the collector of such treasures, that it is on the borders of open glades, and by the side of roads and clearings in the more open and accessible forest that his researches are most likely to be rewarded; the very size of the moths unfits them for a residence in any but open places where they can course about without constantly striking and breaking their wings among the trees and thickets.—The larvæ are often procurable by looking on the ground for the droppings from the insects on the branches overhead, and it is almost invariably in this manner that I have procured the rarer moths, while in “the gloomy recesses” of the denser and Tiger harbouring jungles, I have never captured one.—Beetles and certain Birds may there be found, but not the larger species of Bombycidae.

The true reason why in tropical climates the nocturnal species are less known than the diurnal Lepidoptera, may be owing no doubt, in part, to the dread of those wild animals which prowl about during the hours of darkness, but much more, I suspect, (and in the mountains I know such to be the fact) to the superstitious dread of ghosts and goblins which haunts the imagination of the lower orders, and prompts them in the Sub-Himalayan tracts to place cakes and rice and sweetmeats at the foot of hollow trees as propitiatory offerings to some imaginary demon whose mischievous and malicious propensities are supposed to be thus appeased; besides which, in such a country and climate as that of India, there are few men so wedded to science as to travel perhaps miles away at

midnight to the nearest jungle after the enervating fatigues of intolerable heat and office work during the live-long day unless anxious to catch a jungle fever, or to earn a strait-waistcoat and quarters in a Lunatic Asylum.—People in Europe appear to think that all India beyond the precincts of the Mahratta ditch is a dense forest, and that we have but to step out of the house in order to fall into the jaws of a tiger—or “a ferocious Dhoolie”!

The lateness and the darkness of the hour at which many of the species begin to move abroad, is one reason why they are not more easily procurable,—while during the day time they are concealed by the dense foliage to which they cling, or by the similarity of their colouring to the banks, rocks, dead leaves and trunks of trees to which they resort for concealment and repose; and the collector will at all times, according to my experience, find it far more advantageous to collect the larvæ and cocoons than to search for the moths themselves.—As a proof of this I may mention that I have never yet once met with a specimen of the moth of *Loepa Katinba*, during a residence of twenty years in the mountains, although I have sometimes taken as many as thirty or forty of the larvæ within one rainy season alone.—It is not even in our forests but, among the more open and scattered brushwood that the generality of nocturnal Lepidoptera are to be found.

In describing the species of this Family I shall note, First—The *Eria* group, containing the large Atlas Moth, and the cultivated *Arindi* moths comprised in the genus *Attacus*.—

Secondly.—The *Spur-wings*, or Tussur group, belonging to the genera *Actias* and *Antherea*.—This group naturally divides itself into two sections, the first having the lower pair of wings produced into elongated narrow tails, and the second having them simply rounded without tails.

Thirdly,—we have a group which is at present in great confusion, and which will, I suspect, eventually have to be

divided into three or four groups.—It contains the genera *Loepa*, *Saturnia*, *Cricula*, *Salassa* and perhaps *Brahmaea*.

Loepa and *Cricula* proper, appear to be non-silk yielding, the species making only an open gauze or net work by way of cocoon, and in the former genus, having more the appearance and texture of fine cat-gut than silk; in both the cocoon is unclosed at the upper end.—*Loepa Katinba* however constructs a true silken cocoon pointed at both ends and there are traits in its habits and in the appearance of the larva which will warrant the removal of the species from the genus in which it now stands, and the same may likewise be said regarding a new species lately sent home and which Mr. Moore proposes provisionally to name *Loepa Huttoni*.¹ All these knotty points, however, must be left undecided until further information has been obtained.

Fourthly,—we have the Silkworms proper, or *Bombyces*, including both the Chinese domesticated, and the wild indigeneous, species, to which must also be added the genus *Ocinara* of which I have discovered two distinct species at Mussooree feeding on the leaves of the *Ficus venosa*.

In all these groups, as far as yet known, the distinctions throughout all the transformations, are natural and strongly marked, and how much a close and careful observation of all, in their larva state, was needed, may be gathered from the fact that I have thus been enabled to detect among the domesticated Chinese stock alone, no fewer than five, if not more probably, six, distinct species confounded under the name of *Bombyx Mori*.—This confusion, as I learn from England, was long suspected there, although the means of clearly ascertaining the point were altogether wanting.

In the first group, as here roughly defined, the caterpillars in the earlier stages, are gregarious and sociable, clustering closely together when in a state of repose on the back of a leaf, to which they cling so tenaciously as to render it diffi-

¹ Now *Neoris Huttoni*, (Moore.)

cult to remove them without injury.—The eggs of what may be termed the *Arindi* moths, including the wild *Attacus Cynthia*, are deposited in clusters resembling piles of shot heaped up pyramidally, and are of a faint straw colour, and oval form; but the eggs of *Attacus Atlas* are generally deposited singly, or at most by twos and threes, and are white with a pinkish tinge.

After the second moult the *Eria* caterpillars are less sociable, and gradually draw off from each other as they increase in size and voracity,—but it must be borne in mind, to prevent cavilling, that I am here describing the habits of all these insects as they appear in the natural state, and not as when crowded together under domestication.—They are furnished with six longitudinally disposed rows of rather long, slender cylindrical fleshy spines, or soft tubercles which after the second moult become densely covered, as well as the entire body, with a fine milk—white meal, or powder, secreted from the skin, none being apparent until some little time has elapsed after each moult.—The cocoons, although closely woven, hard, and tough, are left partially unclosed at the upper end so as to render egress easy of accomplishment, and consequently the insects are neither furnished with a solvent nor a wing spur.

The outward appearance of the cocoon when rolled up in the leaf, is generally pear shaped, but on the removal of the outer tough coating, the true cocoon within is generally oval.—The domesticated *Attacus Ricini* has the cocoon somewhat rough and woolly looking externally, and usually either white or orange red.

In all the species of this group it has hitherto been found almost impossible to reel the silk from the cocoon in the ordinary manner, and the mode adopted in India is to card and spin as with wool. In Italy, however, it has been said that the means of reeling have been discovered, and the same was once asserted in Bengal, though the old system is still conti-

nued.—After repeated experiments with various solvents I have found the cocoons quite intractable; I succeeded to a certain extent with the Atlas cocoon by boiling in coarse vinegar, yet even in this the thread always snapped at the termination of each layer of silk, the cocoons unlike those of *Antheraea* being apparently composed of a series of bags one within the other.—Even should a solvent be discovered it must be a cheap one, or no good can accrue from it.—

In the second, or spur-wing group, the eggs are round, somewhat flattened on the upper and under surfaces, and in the wild state are deposited singly, the larvæ not being at all sociable and gregarious.—They grow to a large size and are naked, but armed with six longitudinal rows of short thick conical tubercles crowned with a tuft of diverging, strong, sharp-pointed bristles with which when disturbed, the animal, by suddenly jerking round the head and shoulders, can inflict a sharp smarting wound. The larva moults four times, as in the preceding group, and the colour after the second moult is usually a soft apple green, clear and somewhat transparent; the cocoons are generally of an irregular ovate form, compactly and closely woven, hard, tough, and entire, without opening, and in some there is an external glazed coating, as for instance in *A. Roylei*, which it is necessary to remove before the true silk yielding cocoon can be arrived at.—The moths of this group all eject a fluid solvent from the mouth, but the cocoons being so massive, tough, and compactly woven, render the addition of the wing spur necessary to separate the moistened threads. Warm water is in the generality of cases quite sufficient to enable the cocoons to be reeled.

In the third group, as previously stated, there is at present some confusion, the larvæ of the different genera varying a good deal and proving that a re-arrangement or separation is necessary; for instance, some, as in *Loepa* and *Cricula* are densely clothed with long hairs, in the former genus giving the insect the appearance of being enveloped in the first thin

web of an incipient cocoon, and the cocoon itself is a mere open net work : while in *Loepa katinba* the larva is sparingly clothed with short hairs, but spins a silken cocoon against the surface of a rock, or the stump of a tree.—

The Fourth group, or silkworms proper, have the larvæ after the first moult naked, and, in the domesticated species, which are all Chinese, armed only with a short, slender, and fleshy tubercle, springing from the penultimate segment ; whereas in the wild, or indigenous, species, there are six longitudinal rows of these, besides the central anal one.—The cocoons of all are oval, closely woven, and enveloped in a light loose outer coating, or web, of floss in which the cocoon remains, as it were, supported and suspended.—In the wild species this floss, or outer mantle, generally envelopes the cocoon much more closely and thickly than in the domesticated species, and in *Bombyx Huttoni* of the Western Himalaya, it is glazed on the exterior surface.—In all the species the moths exhibit a very strong similarity in form and marking of wings, and all eject from the mouth a clear, liquid, solvent which dissolves the gum with which the fibres are agglutinated, and which done, they are easily separated by the hooks at the extremity of the forefeet, so as to form a circular opening through which egress is effected.—In the domesticated Chinese species the colour of the worms generally is of a sickly creamy white, more especially so among the annual worms *B. Mori* and *B. textor*,—but there will constantly appear among them a few that are of a dark brindled or irongrey colour, and these, I am assured by cultivators, are invariably the strongest and healthiest of the batch.—This fact is strongly corroborative of some theoretical ideas which I had formed on the subject, and which lead me to suppose that the original or natural colour of the worm was dark, the pale sickly hue being one of the effects of impaired constitution arising from long domestication.—In order to test this opinion, I picked out all the dark coloured worms and kept them separate

and bred from them for two or three years, the worms always remaining dark and the moths being, as I shall hereafter notice, very different in their markings from those produced from white worms. My experiments in the third year were unfortunately abruptly closed by a gale of wind overturning, and irretrievably scattering, the supply of eggs.—I have, however, recommenced, and the results will be hereafter pointed out,—but in the meantime I throw out the hint to Indian and European cultivators as it may possibly furnish them with the means of resuscitating a healthy stock free from the diseases which have lately proved so destructive both in the East and in the West.

In the genus *Ocinara*, the caterpillars, although in many respects similar to those of *Bombyx*, yet show likewise an approach to the dry-stick like larvæ of the *Geometræ*, especially in the earlier stages,—their habits and manner of imitating by their attitude, the twigs and leaf-stalks upon which they rest, and the little knobs, or knots upon the body assimilating them very closely to the species of that genus. They spin a small oval cocoon of silk on the leaf, but there is not sufficient of it to make it profitable. The larva of one species differs somewhat from its congeners in being hairy.—

It may be as well here, once for all, to state that the larvæ of all the species included in this family, are composed of a head and twelve segments, or annulations, the last of which furnishes the anal pair of feet;—from each of the three anterior segments springs a pair of horny, sharp pointed legs, which are termed *prolegs*, and whose use appears to be both as legs and as feelers to guide the animal along the twigs among which it crawls, serving at the same time to preserve the equilibrium of the body when the animal walks along the upper surface of a twig. From the sixth to the ninth segments inclusive, spring the true legs, which are also arranged in pairs; while the anal, or last segment furnishes the strongest pair of all. Thus there are altogether eight pairs

of logs. Each caterpillar breathes through nine pairs of stigmata or spiracles placed low down on the sides of the segments, the first occupying the anterior segment, and the others being disposed from the Fourth to the penultimate segment inclusive.

It is the more necessary to draw the general reader's attention to these points, because some have endeavoured (Mr. Bashford for instance) to establish distinction of species by pretending that the spiracles in some *Bombyces*, such as the Bengal Annual (*B. textor*), and the Nistry (*B. Cræsi*) amount to only eight pairs in the former, and six pairs in the latter; whereas both have the usual number, or nine pairs.—

In the Naturalist's Library, it is even asserted of the larvæ of *Attacus Cynthia* (which, by the way, is as usual confounded with *A. Ricini*) that it has only *ten segments*, which, in a work of such pretensions, is a grave error, as it will be found that the caterpillar, like all its congeners, has the usual number of twelve annulations, and indeed the figure there given of the larva (which moreover is not that of *A. Cynthia*) actually contradicts the letter press by showing that the number of annulations is as usual. Mr. Moore's figure of the larva of *A. Cynthia* as given in the Catalogue of species in the late East India Company's Museum, likewise refers to *A. Ricini*, and is evidently a repetition only of that given in the Linnæan Society's Transactions in 1804, by Dr. Roxburgh, and which has since that time invariably done duty as the larva of *A. Cynthia*. The larva from which the figure was taken had evidently been denuded of the white powder which usually envelopes it, while from the larva of *A. Cynthia* it is easily distinguished from the absence of the black spots between the tubercles. It may likewise here be remarked that there is this distinction observable between the habits of the true *Bombyces* and all the larger species of the family, that these latter, with the exception of the *Eria* worms proper, invaria-

bly, on issuing from the egg, devour nearly one half of the shell before moving away to regale themselves upon the leaves, and they likewise, after each successive moult turn round and devour the old cast off skin,—whereas the *Bombyces* proper, neither eat the egg-shell nor their old cast off clothes.—

As stated in a previous paper the young caterpillars of all the species have the power of spinning a silken thread from the moment they issue from the egg, and previous to their having taken any vegetable nourishment whatever. This substance is consequently purely an animal secretion, and is contained in two long cylindrical reservoirs placed one on each side of the stomach and intestines, and when required for use is ejected at the will of the animal by the action of certain muscles, and thence conducted to the lower lip, which is perforated with two minute holes, placed close together, through which the viscid gum passes, and the two threads thus formed, are instantly drawn together into one, by two small hook-like processes in the mouth, from whence, on issuing, the united fibres on coming in contact with the air, instantly form the elastic substance which we term silk.—(Kirby and Spence. *passim*.)

From these facts, the folly of endeavouring to obtain silk from the bark of the mulberry tree, will be at once apparent; that very fine silky fibres, and pulp for the manufacture of paper may, by a particular process, be obtained is probable enough, but even the existence of these fibres is no novelty, since we find it recorded in the narrative of the Mutiny of the *Bounty*, that in 1825, the officers of the ship *Blossom* which touched at Pitcairn's Island,—“slept in the house all night, their bed clothing and sheets consisting of the native cloth made of the native mulberry-tree.”—(Chamber's Miscellany.)

With these preliminary observations, then, I shall first call attention to the Group containing the *Erĩa*, or *Arrindi* moths of the genus *Attacus*; and here in the very outset we are

met by the declaration of the French Entomologists that *A : Cynthia* is not indigenous to India, but is to be found only in China and Japan, where the worm is said to feed on the leaves of the *Ailanthus glandulosus*, or Varnish tree.—On this point, however, unless it can be proved that the species figured by Cramer as such in Vol: 3. pl 39, fig. A, is distinct from that figured in Westwood's Edition of Drury's Exotic Entomology Vol. 2 pl. 6,—the true *Attacus Cynthia* must not only be admitted as indigenous, but to be in the North Western Himalaya one of the commonest species of the family.—Drury's figure is, no doubt, somewhat of a caricature, but Cramer's is accurate enough, and corresponds exactly with numerous specimens now before me.—Little reliance can be placed on the figure given in the Illustrated London News,* since the entire picture is a mass of confusion, and has been elaborated out of different sexes of two distinct species! The wings of the moth are evidently intended to represent those of a female *A : Cynthia*, while the *Antennæ* are those of a male; the body of the insect is that of female *A : Ricini*, to which species belongs the cocoon; while the caterpillar, judging from the spots, is apparently intended to represent the larva of *A : Cynthia*.—Altogether the confusion is most complete, and calculated to mislead all but a practised Entomologist.—

It would appear, then, that the French savans have fallen in to error from an imperfect acquaintance with the species occurring within the limits of this vast and (scientifically) much neglected Empire; nor, considering the little that is certainly known on this subject both by our own Entomologists in England, and by soi-disant savans in India, is there the slightest room for wonder at such a result.—I shall therefore, until driven from my ground by the production of a Chinese species differing specifically from ours, continue to maintain the occurrence in India of the true *Attacus Cynthia*.

* No. 1069, vol. 38 January 12th, 1863.

GENUS ATTACUS. LINN.

1. *Attacus Cynthia*.

Phalena-attacus-Cynthia.—Drury's Exot. Ent. 2, pl. 6. f. 2 ;

Cramer Pap. Exot. 3. pl. 39. f. a.—

Saturnia-Cynthia.—West w. ed. Drury's Exot. Ent. 2. pl. h. f. 2.

Attacus-Canningi.—Hutton. Journ. Hort. Soc. of India.


Bombyx Cynthia.—Fabricius.

This beautiful species, the true *Attacus Cynthia*, occurs abundantly in a wild state at Mussoree in the North Western Himalaya, extending upwards from the valley of the Dehra Doon, where it is likewise common, to an elevation of about 6,000 feet above the sea. It ranges Eastward along the base of the mountains to Almorah, Nipal, and thence to Assam and Cachar. In the Catalogue of species contained in the late East India Company's Museum, it is even said to have been received from Ladakh, which is, I imagine, an error, the specimens having been received from Captain Strachey, who, in all probability captured them in Kumaon, many species from the same collection being stated in that Catalogue to be from Ladakh because their donor travelled there, although strictly belonging to the outer Southern ranges.

Specimens kindly sent to me by Mr. C. Brownlow from Cachar, differ in nothing from those occurring at Mussooree, where it feeds on the Tez-buhl, or *Xanthophyllum hostile*, the Mansuri or *Coriaria Nipalensis*, and a few other indigenous shrubs. Like the common domesticated *Eria* of Bengal, it will likewise eat the leaves of the Castor Oil plant, although it does not appear to take kindly to it, and I have even reared it easily enough on the common Cape Woodbine, so that its introduction into England seems feasible enough, especially as the *Atlantus glandulosus* is said to thrive there.

The moth usually appears at Mussooree early in June, depositing its eggs in little pyramidal clusters on the back of the

leaves of one of the above mentioned shrubs. These are of a yellowish white, or pale straw colour, and when the caterpillars come forth, which they do in ten days after deposition, they are for some time gregarious, separating only as they acquire size, and require, consequently, a greater supply of food.—

When first hatched the caterpillar is of a dull yellowish hue, with six longitudinally disposed rows of small tubercles, giving forth tufts of minute black bristles, between which are rows of small round black spots; head and prolegs shining jet black; a short transverse black band on the anterior segment, generally assuming the shape of the head or cross-bar of the letter T—thus ; anal feet and the edge of the anal shield, black.—

This is the appearance of the little animal in the first stage when seen under a lens.

In the second stage, after the first moult, the colour of the body is of a deeper yellow, approaching to pale orange; the head and prolegs shining black, as before; tubercles still armed with tufts of short black bristles; the black transverse band on the anterior segment is now replaced by two obliquely placed black spots, one on each side. The black spots between the tubercles as before.

After the second moult the body becomes milk white and all the tubercles are of the same snowy colour, except the lower lateral row where they are black; tubercles long, cylindrical and fleshy, and now without any bristles; the head and prolegs still black; anal shield edged with black, and a spot of the same on the anal feet; the rows of black spots between the tubercles still continue and are now conspicuous, contrasting well with the snowy whiteness of the body. These black spots are marks in the skin, but the milky whiteness is caused by a thick coating of powder secreted from the skin, and falls off when the animal is handled. The true colour beneath this is a faint tinge of green.

In the fourth stage after the third moult, the body and all

the tubercles are white and thickly covered with the powder ; head now yellowish green ; prolegs black ; stigmata black ; the last segment of the body pale greenish yellow ; border of the anal shield, and of the anal feet ultramarine blue. The black spots as before.

After the fourth moult the appearance is the same, except that there is an ultramarine blue band on each of the true legs, and the tips of the long fleshy tubercles assume the same bright hue, giving the animal a very beautiful appearance ; the rows of black spots still continue conspicuous upon the white powdered surface of the body, and the stigmata are also black ; ground colour of the body a beautiful sea-green, thickly veiled beneath the coating of pure white powder, and with which the tubercles are also loaded.

In this stage I have endeavoured to represent the caterpillar in Fig 1 on the accompanying plate, but it is next to impossible to impart the powdery appearance, or to represent the full beauty of the insect in its natural and undisturbed state as seen among the bright green leaves of the shrubs on which it feeds.

The caterpillar spins a hard oval cocoon within the leaf which is rolled round it. At first the silk is of a glossy whiteness, but changes afterwards to dull sandy brown, or grey, on drying and exposure to the air. A strong silken rope is fastened along the twig from which the cocoon depends, so as to prevent its falling when the leaves decay.

In the form of the cocoon, and in the mode of attachment to, and dependence from, the tree, this species appears to make a very near approach to *Saturnia Promethea* of North America, and indeed, to judge from the published figures the male insect of that species has much more the appearance of an *Attacus* than *Saturnia*.

The caterpillars are often infested with a small black Ichneumon fly which destroys great numbers, issuing from the cocoons at the season when one expects to see the moth burst

forth. At Mussooree, in the wild state the species is an Annual only, but when reared in the house a stray moth will occasionally come forth at an unseasonable time, when there are no wild ones about. This is owing probably to the temperature of the room in which the cocoons are kept. A female came forth last year on the 6th of November and was placed outside on a shrub to attract a male but from the lateness of the season none appeared, and the female remained perfectly stationary until the 18th of the month, a period of twelve days without nourishment, when she died. This species can be reared with very little difficulty by tying out the females all night to a shrub, and setting the males at liberty near them. In the house they will also frequently pair if plenty of room be allowed them, but they will not remain stationary and tractable like the moths of *Attacus Ricini*. This, however, might possibly be effected by continued domestication.

I succeeded in obtaining a cross between this species and the Bengal *Attacus Ricini*; the caterpillars resembled those of the Himalayan species, and the only difference observable in the moth was that the colours were more dull and the specimens scarcely so large as in *A. Cynthia*.—The annual character of the latter was, however, at first altered, and a second brood was obtained, thus showing the partial influence of *A. Ricini*; this advantage was nevertheless of short duration, as all reverted to annuals in the third year; indeed beyond the multiplication of broods there is actually nothing to be gained by crossing, as no improvement in the silk, or alteration in the cocoon took place.

Experiments tried by M. Gnerin Meneville in France were attended by nearly similar results.

Description of the Moth:—Head greyish brown, sprinkled with a little ash; eyes brown black; antennæ yellowish brown, deeply pectinated, and, as usual, broader in the male than in the female. Thorax and body yellowish brown, the former bordered anteriorly by a narrow collar of ash, and posteriorly

by a broader transverse band of the same colour ; upper part of the abdomen with a narrow transverse ashy bar, divided from that of the thorax by a brown separating line ; abdomen furnished above with three longitudinal rows of white disconnected tufts, which, in the central or dorsal line, are posteriorly bifid or notched ; on each side of the abdomen is a longitudinal ashy band on which are brownish rings, or circles, bearing the stigmata within, and there are two similar bands on the underside of the abdomen and of anal segment, ashy white. Legs brown, margined posteriorly with ash. The wings in both sexes are falcate, but most so in the male, the greater weight and bulk of body in the females of this family probably requiring a fuller and more ample developement of wing to support it. General colour of the upper surface of the wings brown tinged with yellow, the basal portion in which the crescents, or lunulæ, are placed, being the darkest ; from near the middle of the anterior margin of the forewings arises an undulating or irregular narrow ashy bar, which is continued through the posterior wings nearly parallel with the external margins, and ending near the abdominal corners ; interiorly, this line is bordered by a narrow black one, and exteriorly by one of a purplish roseate hue, beyond which is a parallel border of ash on a dull purplish ground, and again beyond this the wing is of a paler yellowish brown, minutely irrorated with blackish dust ; the external margins of both wings are of a dull olive greenish hue, traversed throughout by an irregular double narrow line of yellowish brown on the posterior wing, the inner one being sinuous and the external one straight or following the curvature of the external margin ; on the anterior wing there is one yellow and broader line only, which is broken, or indented at the falcate bend of the wing by a loop in the olive border which is here bounded by an internal blackish line ; the tips of the wings have a roseate or peach blossom blush, and are wrinkled for a short distance by two rows of indentations, at the extremity of the second of

which is a dark ovate spot margined superiorly by a narrow white crescent which is continued in a zigzag thread to the anterior margin.

From the transverse ashy band on the posterior part of the thorax, runs a similar ashy bar towards the centre of the upper wing, where it branches off into two short diverging lines to meet the upper lunule, from which it suddenly turns upward and backward at an angle to join the anterior or costal margin; this ashy bar is bordered on both sides by a narrow black line; from the angle of this band to the ashy descending bar which traverses the wing is a crescent or lunule which is yellow on the lower margin, black on the upper margin and inclosing a narrow talcose or diaphanous centre; on the disc of the lower wing is a similar crescent, and from near the base of the abdominal margin of the wing, on a line with the extremity of the abdomen, runs an ashy bar towards the anterior margin, curving round to join the ashy roseate band which descends through the wing; the basal or interior portions of the lower wings are thus, when expanded, distinctly marked with a heartshaped patch bounded by an ashy line, and this indeed appears to be a characteristic feature in the marking of all the species contained in this group.

The underside of the wings exhibits nearly the same markings with the exception of the ashy bar on the disc of the upper wings, which is not seen, but the colouring is far less bright, and the basal portion is of a deeper brown and less ochraceous, the black line of separation between the base and the exterior margins being likewise well defined.

The expanse of the wings is generally about $5\frac{3}{4}$ inches, of those bred in the house, which is the size mentioned by Drury although in wild specimens many often reach beyond $5\frac{1}{2}$ inches. Both Drury and Cramer give China as the habitat of their insect, and whatever Drury's figure may represent, it is evident that Cramer's is in all respects identical with our Himalayan species.

It is right amidst all the errors and conflicting statements which have so long prevailed in regard to this species, to draw attention to the fact that the reason why the French Entomologists have been induced to deny it a place in the Fauna of India, arises solely out of the confusion which has hitherto prevailed on this subject among ourselves, a fact which is rendered apparent by the following extract from Silliman's Journal for November 1858.

"One of the most active and distinguished of the members of the Society of Acclimatation, Mr. Guerin Meneville, who has been especially interested in the introduction of new silkworms, has recently succeeded in acclimatizing in France a new silkworm from China, where it lives on the Varnish tree (*Ailanthus glandulosus*.) The species is the true *Bombyx Cynthia* of Drury (1773), figured for the first time by Daubenton, junior, in his coloured plates which were published between 1760 and 1765, and raised for some centuries in China, where its silk clothes the people. Roxburgh in 1804 supposed the *Eria* which is raised in British India to be the same; and this confusion has continued till recently: so that the *Eria* (or Arrindy-Arria, as it is called in Hindostan) has gone by the name of *Saturnia Cynthia*. The *Eria* is a different species living on the *Ricinus*." Now this, although perfectly true as a general statement of facts, still looks very like "*a Mare's Nest*," when the species is called "*a new silkworm*;" since it was figured, and therefore known to the younger Daubenton in 1760,—was possessed by Drury in 1773 and has been cultivated for Centuries in China, so that the utmost that can be said is that the French Entomologists have acclimatized a species which was known to their countrymen a century ago, and which they have at length discovered to be distinct from the *Attacus Ricini* of Bengal; and as, whenever they applied for *Attacus Cynthia*, the *Attacus Ricini* was, through sheer ignorance of the difference, invariably supplied, they jumped to the conclusion that it was the only species in India.

It may be observed, however, that I discovered this Chinese species to be wild at Mussooree in 1844, and have twice sent home its cocoons to M. Guerin Meneville himself, who has lately informed me that they were all destroyed during the journey. Cocoons and moths received from that gentleman are perfectly identical with ours.

The species was known to me to be indigenous nineteen years ago, and it was only when M. Guerin Meneville so authoritatively declared it to be peculiar to China, that I provisionally changed the name of our insect to *Attacus Canningi*. The error, is however now corrected, and the fact fully ascertained and published that the true *Attacus Cynthia* is as common in the Sub-Himalayan tracts, as it is in China, and if it be true (which I doubt) that in that country its silk clothes the people there can exist no good reason why it should not with us be turned to good account also.

An attempt was made in 1861 by Dr. Bonavia to introduce this species into Oudh, with a view to its ultimately becoming of commercial value, but by a recent letter from that gentleman, I regret to learn that the experiment for the present has failed, owing greatly, as he thinks, to the attacks of ants and various species of wasps and Hornets. Although these pests, no doubt, annually destroy vast numbers of the larvæ, even within our hills, yet, I suspect the great heat of the climate in Oudh combined with uncongenial food may have had far greater influence in destroying the worms than even the ravages of insects; because Dr. Bonavia found that they still died even when protected under a gauze curtain. In China, and, as it likewise appears, in France the worms are fed upon the leaves of *Ailanthus glandulosus*, whereas in Oudh Dr. Bonavia attempted to rear them on the *Ailanthus excelsus*, and although the trees, as species, may be closely allied, yet it does not therefore follow that the worms will thrive equally well upon both. I have found, indeed, that the domesticated Chinese Bombyces, although when deprived of other food

they will eat sparingly of the coarse rough leaves of the wild Himalayan Mulberry, which is the natural and favorite food of *Bombyx Huttoni*, yet cannot be reared upon them alone, and the same is the case in other instances; strictly speaking each species is provided with its own particular and appropriate tree, or shrub, and when fed upon that the silk produced is always of superior quality to that which is produced when the worms are fed upon other trees; so that provided the insects are protected from too much heat,—the attacks of wasps and ants, and are supplied with suitable food, I do not see why *Attacus Cynthia* should not eventually succeed even in Oudh; but of course if exposed, as in the late experiment, to the full blaze of a Tropical sun, the constant worrying of enemies and are besides supplied with a food which in a state of freedom they would probably avoid, and which they eat when domesticated solely because nothing else is procurable, then, doubtless, it would be a waste of time and labour to attempt the cultivation of the species out of its own native haunts.

Of four different batches of eggs sent to Dr. Bonavia, he reports that of each one or two worms only lived to undergo the second moult, and then either died or disappeared.

Specimens of this moth sent to me by Mr. Brownlow of Cachar are in all respects identical with those found at Mussooree; but although the *Attacus Ricini* is there cultivated, it does not appear that any attempts have been made to reclaim the wild species, which moreover, according to my zealous correspondent, is not very common. In Cachar the worm feeds upon a plant which is there called "*Lood*."

2. *Attacus Ricini*. (*Boisd.*)

Saturnia Ricini.	? Boisd. Am. Soc. Ent. Franca.
Attacus lunula,	Walker. Lept. Het. B. M.
Attacus Ricini,	Moore. Cat. Lep. Mus. E. I. C.
Phalaena Cynthia,	Helfer, J. A. S. vol. vi. p. 45.
Phalaena Ricini,	Sir. W. Jones, (1791.)

Phalœna Cynthia,	Roxburgh, (1804.)
Phalœna Cynthia,	Dewhurst on the Silkworm.
Saturnia Cynthia,	Nat. Lib.
Bombyx Cynthia,	Boitard. Cult. du Murier.
Eria of Assam,	Hugon and Royle.
Arrindy Arria and	} Helfer, J. A. S.
Eria Silkworm,	
Arrindy worm of	} Roxburgh.
Dinagapore,	
Attacus Guerini ?	Moore. Cat. Lep. Mus. E. I. C.
Attacus Arrindia,	Guerin-Méneville.

This species, which until recently has been invariably confounded with *A. Cynthia*, is I suspect that which has been introduced into Italy and Malta as recorded in the Proceedings of the Entomological Society for December 1854, and to which "The Illustrated London News," alludes when it erroneously says that—"in the beginning of 1854 the first announcement was made that there existed in India a species of silkworm which lived on the Castor Oil tree." This statement, considering that Sir William Jones in 1791, and Dr. Roxburgh again in 1804, in a paper published in the Linnæan Society's Transactions, recorded the existence of a silkworm which was reared on the Castor Oil Plant, affords a strong proof of the general want of knowledge which still prevails in Europe regarding the species found in India, and fully excuses my rough attempt to dispel by a series of monographs, the darkness and confusion which at present enshroud the subject. That frequent notices of the occurrence of the Eria worm in various parts of the country have from time to time appeared is a fact beyond dispute; yet equally true is it that the writers of such reports were not only unable to say to what species they referred, but were unaware of the existence of more than one in India; and hence is it that we have heard of the cultivation of *A. Cynthia* all over the country, while the specimens furnished to Europe were those of *A. Ricini*.

But besides this, it is to be observed that in consequence of this inexcusable confusion the specimens of Silks, whether raw or manufactured, which have been exhibited at National Exhibitions, or before commercial and scientific associations, have hitherto been passed off as the produce of the wrong species, such products being those of *A : Ricini*, and never, as far as India is concerned, of *A : Cynthia*. A question may arise as to what species Mr. Hugon refers as the *Eria of Assam*, for although his rough figure of the moth might seem to indicate *A : Cynthia*, yet his description of the caterpillar, and of the number of crops of silk obtainable in one year, point decidedly to *A : Ricini*; for, as already stated, the former species is an Annual only. There is besides a well marked distinction between the larvæ of the two species which observers would do well to note; those of *A : Cynthia* having rows of well defined black spots between the tubercles in every stage, while in those of *A : Ricini*, they are totally wanting. The spots mentioned by Mr. Hugon as existing in the two first stages of the Assam caterpillar, are in reality not such, but are formed by the black tufts of bristles which in those stages crown the tubercles themselves, and which, as he acknowledges, disappear when the larva assumes its white powdery garments. The number of broods obtained in a year he likewise states to be seven, while the favorite food is the leaf of the *Ricinus communis*: a plant which the larvæ of *A : Cynthia* will eat when nothing else is procurable, but which in a wild state it never touches.

From all this it is perfectly evident that the cultivated *Eria* of Assam of Hugon and of Roilé is not, as Mr. Moore has doubtfully stated, *A : Cynthia*, but the domesticated *A : Ricini*; and indeed specimens of the Insects and cocoons which I have through the kindness of friends received both from Assam, and Cachar, where the broods are twelve in number, place the question beyond all cavil. Mr. Moore in his pamphlet on the Bombycidae, informs us that—"the speci-

mens from Assam are identical with those named *A : lunula* by Mr. Walker, and with others sent from Paris as *A : Ricini*?

This species can be reared without the slightest difficulty, as the moths voluntarily couple like those of the *Bombyx Mori*, without attempting to escape. The caterpillar is fed upon the leaves of the Castor oil plant, but whether this is the natural food of the worm in its wild state, or from what district or country it was originally procured, remains for the present a mystery. It would not surprise me however if we were yet to learn that, like the domesticated *Bombyces*, it was procured from China, where it may yet perhaps be found that the silk which clothes the people and is now referred to as the produce of *A : Cynthia*, is in reality that of *A : Ricini*. If this be not the case, then whence did the species come? for in 1804, when Dr. Roxburgh wrote upon the subject, he and his correspondents distinctly and positively stated that the only districts in Bengal where an *Eria* was then found were those of Dinajpur and Rungpur, "This insect" says Dr. Roxburgh, "known to the Hindus by the name of *Arrindy* in some parts, in others *Arundi*, appears to be peculiar to the interior parts of Bengal; and as far as I can learn, to two districts only, namely Dinajpur and Rungpur, where the natives breed and rear it in a domestic state, as they do the common silkworm. The food of the caterpillar consists entirely of the leaves of the common *Ricinus* or *Palma Christi*, which the natives of these districts call *Arrundy*: hence the name of the insect." By the Dr's. correspondents the species is asserted to have been at that time entirely confined to the two districts above mentioned, and Mr. Creighton of Malda, writing in 1800, distinctly says, "It is entirely confined to the districts of Dinajpur and Rungpur, no other place in Bengal having got it." Mr. Creighton in one of his letters to Dr. Roxburgh also mentions the existence of a cocoon on the mango tree which he says the natives gather and mix with the silk of the *Arrindy* worm; this is very probably

not a cocoon, but the *nidus*, or residence of the larva, of some species allied to *Lasiocampa* and feeding on that tree.

Granting, then, that all this was true in those days, it appears somewhat remarkable that the species up to the present time should never have extended much beyond those districts, where it still continues to be cultivated. The cocoon produced is however very far inferior to those of Assam and Cachar, and somewhat resembles, though it is only half the size of, that of *A: Cynthia*,

As might be expected in such closely allied species, the caterpillars have precisely the same habits as those of *A: Cynthia*, clustering together in the early stages and clinging to the leaf with remarkable tenacity. The eggs are piled up in a similar manner, and are of a paler shade of yellow, approaching almost to white. The appearance of the young caterpillar strongly resembles that of the Himalayan and Chinese species, but there are no black spots between the tubercles, and when full grown the colour as seen beneath the white powder is pale azure instead of sea green as in the other. The moths, with a general similarity in the form, and disposition of the markings are yet unmistakably distinct.

In its first stage the caterpillar is of a dull greenish yellow, with six longitudinally disposed rows of small tubercles, giving forth at the summit a tuft of black bristles; head and prolegs shining jet black; a black transverse band on the anterior segment, as in the last; anal feet and edge of anal shield, black.

In the second stage, after the first moult, the head and prolegs are still shining jet black; body pale orange yellow, the tubercles giving out black hairs as before; the black transverse band on the first segment is now narrow and divided in the middle; stigmata black, and a short, narrow, obliquely placed black line above the second and third prolegs; a black spot on the anal foot, and black transverse band on the true legs; there is also, as in the last, a tubercle on the dorsal centre of the penultimate segment.

In the third stage the head and prolegs are shining jet black ; anal shield edged black, and a black spot on the anal feet ; body and all the tubercles white, except the lower lateral row where they are black ; tubercles fleshy and without the apical tuft of black hairs.

After the third moult the head becomes yellowish ; prolegs black ; body snow white, and all the rows of tubercles are now also white and thickly coated with a white powder ; stigmata black.

After the fourth moult there is little change, except that the ground colour of the body is in reality of a beautiful pale azure blue, veiled beneath the thick coating of white powder with which it is completely overspread.

As in the last species, the cocoon is spun upon the leaf ; but instead of being externally smooth, hard, and compactly woven, it presents a somewhat loose, woolly, or flossy appearance, and instead of being of a sober grey, is either white or deep orange. It is besides somewhat pointed at each end instead of being pear-shaped.

In India hitherto, the silk has I believe never been unwound or reeled from the cocoons, which are torn to pieces, carded, and spun like cotton or wool. It was, however, stated in 1854 that M. Lotteri in Italy had succeeded in reeling it, yet in India, as far as I can learn, the old method still continues to be practised.

Description of the Moth ; The form, colouring and markings of the insect bear a strong resemblance to those of *A. Cynthia* from which nevertheless it is totally distinct. The colours of different specimens vary a good deal in intensity. The ground work of the wings is greyish brown in some, and yellowish brown in others, and there are the same light ashy coloured bands traversing the wings as in *A. Cynthia*, but they are far broader, while the rosy band which traverses both wings of *A. Cynthia* is here altogether wanting ; on the disc of each wing is a lunule, which in the superior pair is traversed by

the descending ashy band, and often nearly obliterated by it. Head yellowish brown divided from the thorax by a narrow white or ashen ring; thorax brown terminated posteriorly by a transverse bar of ash; body wholly clothed in ash coloured down, and thus presenting a strong and well marked distinction between it and *A. Cynthia*. Expanse of wings in domestic specimens seldom exceeding four inches.

It has been asked, and the question is one that has frequently occurred to me, whether it is not probable that *A. Ricini* has been derived from *A. Cynthia* as the original stock, and become modified and changed by domestication.—Looking at the question in all its bearings, I have been induced to reject the idea as altogether untenable, for however strong may be the general resemblance, there are characters to be taken into consideration which, in my opinion, fully and satisfactorily determine the total distinctness of the species. Besides, if we are to suppose that *A. Ricini* is merely a domestic variety of the Chinese and Himalayan *A. Cynthia* we are compelled on equally unsubstantial grounds to go a step further back, and derive *A. Cynthia* in like manner from *A. Atlas*. Looking, however, to the larvæ of these species, and regarding them in the light of their embryos, we find that they likewise exhibit marked distinctive characters in all their stages, and which are moreover constant and invariable, which, if identical as species, ought not to be the case; for however much domestication may conduce to the alteration of colouring, size, and strength of constitution, and even, to some extent, of the habits of a species, the embryo will still remain unaffected (except constitutionally) by the change, while the disposition of markings in the adult will likewise remain unaffected. Now the differences between *A. Cynthia* and *A. Ricini* are these;—the former is an annual, the latter has from 7 to 12 broods in a year*; the larvæ of the first has rows of black dots between

* This is Dr. Helfer's statement and must be an error, for there would be no time for 12 broods in a single year!

the tubercles in every stage, which are entirely and constantly wanting in the latter; and these spots are not merely marks in colouring, but are marks in structure; that is to say, they are not evanescent and delible like the snow white powder with which the body is covered, but are imprinted by nature on the skin of the animal. In the adult, or imago state, *A : Cynthia* has the body naked, and merely ornamented with open rows of ashy tufts, while in *A : Ricini* the whole body is closely clothed with down. In a wild state *A : Cynthia* rejects the *Ricinus communis* as food, and will only eat it under domestication when nothing else is to be had; whereas *A : Ricini* prefers it to any other food.

What, moreover, shall we say in this case in regard to the great Darwinian Theory of "Natural Selection" improving a species? Here we have before us, not an instance of improvement for the benefit of the species, but—if *A. Atlas* be the parent stock,—strong marks of degeneration from, and deterioration of the original type. For Darwin's theory is, that natural selection acts solely for the improvement of species, and that man by copying nature brings about similar results by domestication;—while here we have not only faded colours, but diminished size, smaller cocoon and a less hardy constitution. It is true that by the multiplication of broods, more silk is produced; yet this, while it tends to benefit man, in no wise adds to the comfort and welfare of the insects themselves, but on the contrary, if artificially produced, must materially weaken the constitution by an unnatural strain and drain upon it. Natural selection, acting only for the good of the species itself, and having no eye to the replenishing of man's pockets at the expense of the species, might, if we accept the theory, be supposed rather to have begun with the variety called *A : guerini*, and converted it into *A : Ricini*, that again into *A : Cynthia*, terminating the process in *A. Atlas*, the largest and finest species of the group. Natural selection, then, is here out of the question for the

result arrived at, instead of being the improvement of the original type, is actual degeneration, and looks wonderfully like what an Irish sergeant would call—"Advancing three paces backwards."

Putting Darwin's crotchets on one side, as totally inapplicable to the present question, we have only to consider the matter as the result of domestication and, so called, cultivation;—but has cultivation produced the desired effect? Has it improved upon the supposed original species? I shall perhaps be told that it has, inasmuch as while *A : Cynthia* produces only an Annual crop of silk *A : Ricini* produces 6 or 7 crops! This no doubt would be admitted as an improvement, if we could show identity of species, which we cannot do, and which is the point in dispute; the larvæ speak loudly in favour of distinctness, while cultivation should not only have increased the quantity of silk, but the size and constitution of the insect likewise! The contrary, however, appears to have been the case, for the Cocoon of the long cultivated *A : Ricini* is infinitely smaller than that of *A : Atlas*, the original wild type! If, then, years of cultivation have only tended to multiply the number of crops by impairing the constitution and diminishing the size of the cocoon, degeneration has been the result, accompanied only by a slight change of habit in the species, which now spins six or seven times a year instead of once as formerly.

Again, it has been urged that the very fact of a cross between *A : Cynthia* and *A : Ricini* having been effected by M. Guerin-Meneville in France, and by myself at Mussooree, should be regarded as proving identity of species. But of what value is such a fact in its bearing upon the point at issue? Did I not likewise obtain a cross between the wild *Bombyx Huttoni* of the North Western Himalaya, and *B : Mori* of China? Are they consequently identical? Did I not likewise repeatedly obtain a reciprocal fertile cross between *Antheraea Roylei*, the Oak feeding Himalayan species, and

Antheraea Paphia, the tussur of Bhagulpore, two species which are undoubtedly distinct?

There is consequently no proof whatever that species are identical merely because they will readily cross and intermingle, since all closely allied species are occasionally found to do so, even when left entirely to Nature, as witness Mr. E. Blyth's remarks on the natural intermingling of the wild Himalayan Kallidge Pheasants (*Euplocomi*), and every one knows that the Pheasant and even the Black Cock in Great Britain, will sometimes voluntarily cross with the domestic barn-door hen.

Taking all things into consideration, then, I see no more reason for supposing the domesticated species of the *Eria* group to have descended from the wild *A. Cynthia*, than there is for deriving the domesticated mulberry feeding Bombyces of China from the wild *B. Huttoni* of the Himalya; and consequently, adopting in this respect the opinions of the leading Entomologists of Europe, I maintain the entire distinctness of the two species above described.

With respect to *A. Guerini* (Moore) it will be seen that I have noted it as a mere variety of *A. Ricini*; but at the same time I am bound to confess that I do not by any means think the question is at all satisfactorily decided; because while I regard the specific characters given by Mr. Moore as possessing very little value *per se*, there are nevertheless other facts connected with the history of these insects which, when properly investigated, may possibly lead to the establishment of the species. If it be in reality distinct from *A. Ricini* from whence is it procurable? I can find no trace of its existence in any part of India, unless it should eventually prove to be that which is cultivated in Rungpore and Dinagepore as *A. Ricini*! Mr. Moore notes the absence from the upper wing of the lunule, which is replaced, he says, by a round spot formed by the junction of the two transverse ashy bands, and likewise, that in size it is smaller than *A. Ricini*. I

have specimens of the latter, which, from imperfect feeding, are not only smaller than they ought to be, but in which the lunule of the upper wing, although not absolutely absent, is yet nearly obsolete, being almost blended with, or absorbed by, the ashy bar that traverses the wing from the costal to the posterior margin. In this specimen there is no spot at all, but in two others there is what may be termed an incipient spot, although the lunule still exists.

On the other hand it is to be observed that specimens of cocoons kindly sent to me from Rungpore and Dinagapore, were true miniatures of the cocoons of *A : Cynthia*, and did not in the least resemble those of *A : Ricini* from Assam and Cachar, being pear shaped, hard, compactly woven, without floss, and of a pale ashy hue. Unfortunately neither these, nor several batches of eggs, were fertile.—Can it be that *A : Guerini* is after all the species spoken of by Dr. Roxburgh and his correspondents, as exclusively confined to Rungpore and Dinagapore? Or is the species now cultivated there merely a degenerated race of *A : Ricini*? Or again, if distinct, then whence was the Assam and Cachar species procured?

These are all questions of some importance, not only to the Entomologist, but likewise to the cultivator of silk; for until it be clearly ascertained, once for all, what species we really have under cultivation, it will be impossible to prevent that mixture of different qualities which has often been complained of, but never remedied.—In the Tussur group I know that the silk of three distinct species is mixed up as that of *Antheraea Paphia*, without the cultivators being aware that there is more than one species in the country.

It was with a view to set these matters straight that I long ago urged the Horticultural Society to apply for my services in ascertaining what species we really had or could introduce, and I venture still to say that until some one possessed of a little Entomological knowledge is thus employed, we never

shall know what the true resources of the country in this respect really are.

There is now merely one other point upon which I shall touch before passing on to the next species. It will be seen in Pl. 1. that figure 1. represents the adult larva of *Attacus Cynthia*; figure 2. is a representation of the adult larva of *A: Ricini*, but what is figure 3? If *A: Guerinii* be in reality a species, then this may represent its larva, for it resembles Dr. Roxburgh's figure and is indeed that which has ever done duty for the whole family of *Eria* moths, from his time until the French savant pointed out the confusion existing in this respect. This figure was kindly furnished to me by Mr. A. Grote who had it copied from a drawing of the late Mr. R. Frith, as that of the larva of *A: Ricini*, which unless the specimen were washed before the limner painted it, it assuredly is not. I have added it to the others in the hope of eliciting some information on the subject.

The cocoons of this species, as well as those of *A: Cynthia*, being open at one end, the moth effects an exit without injuring the threads; in any case, however, since the silk is carded and not reeled, this does not much matter, and all the cocoons can consequently be turned to good account. Why might not silk be carded in like manner from those cocoons, now worthless, of *Bombyx Mori*, from which the moths have been permitted to eat out, as it is termed?

We now come to the largest species of the group in India, the silk of which although said to be turned to good account in China is so extremely difficult to reel that in all probability the method pursued in China is the same as that practised for the *A: Cynthia* and *A: Ricini*.—After repeated trials in various solvents I have hitherto proved unsuccessful in doing more than unraveling to a certain extent, with the certainty of the thread snapping at every few feet.—This intractability seems more attributable to the peculiar manner in which the cocoon is formed than to the insolubility of the agglutinating sub-

PLATE I.

FIG. 1.



FIG. 2.

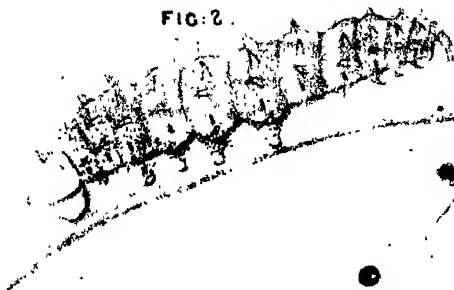


FIG. 3.



FIG. 4.



stance, for the cocoon appears to be composed of separate layers or silken bags one within the other, and the thread is sure to snap at the end of each of these.—There seems no reason, however, why the silk should not be carded and spun after the method pursued with the Assamese Eria, *A. Ricini*, and if this be accomplished the silk may be brought into the market, as the insect is easily reared, and is abundant in some of the Sub-Himalyan tracts.—If difficulty be experienced in inducing the sexes to couple in the house, the females may, like several other species, be tied out at night where wild males are known to exist, and this method will almost always be successful.—In Cachar my correspondent Mr. C. Brownlow, to whose zeal and kindness I am much indebted, informs me there are two broods in the year,—but at Mussooree we obtain one only during the rains,—and the same is I believe, the case at Almora.

The species here alluded to, is the well known

Attacus Atlas (Linn.)

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|-----------------------------|--|
| Phalœna Attacus Atlas. | Linnaeus. |
| Bombyx Atlas | Fabricius Syst. Ent. Spec. Ins.
ii. p. 167; Olivier Enc.
Meth. Ins. pl. 69. f. 1. |
| Attacus Atlas | Hubner, Verz. bell. Schmett.
p. 156; Walker, List Lep.
Het. B. M. pt. 5 p. 12 18;
Moore Cat. Lep. Mus. Ind.
House ii. p. 405.— |
| Var. Phalœna attacus Atlas. | Cramer, Pap. Exot. i p. 13 pl.
9 f. a. |
| Var. Saturnia Sylhetica ... | Helfer, J. A. S. Beng. vi. p.
41 (1837.) |
| Saturnia Atlas | Donovan's Ins. China. pl. 42. |
| Hyalophora Atlas | Nat: Lib. For. Moths. |

The range of this species appears to be very extensive, as the insect is found at Mussooree, Almora, Sylhet, Cachar,

Java, China, Madras, Ceylon and Burmah.—Mr. Moore cites the figures given by Cramer in pl. 381. f. c. and pl. 382. f. a. as representing this species; an opinion in which I do not concur, for the differences observable both in the marking and shape of the wings are very great, and Cramer, although calling it *A. Atlas*, says it came from Amboyna.

In Cramer's figures the external edges of the wings are represented as slightly sinuated or scalloped; the talcose or vitreous spaces within them are not only very much smaller, but are of a totally different shape from those of true *Atlas*, and the lower wings are entirely destitute of the transverse curved ashy band, which tends to form the cordate space so conspicuous in the other members of the genus. Added to these differences, the chain like bands along the external margins are also absent, and altogether there are so many points of difference that I cannot help regarding the insect as a totally distinct species which might very well bear the name of *A. Amboinensis*. The variety figured by Cramer, as fig. A. Pl. 9, I have received through the kindness of Mr. C. Brownlow from Cachar; it is a female, and the male sent with it differs in nothing from the Mussooree specimens, save that the colours are less dark.

This species appears to be almost omnivorous, feeding in different districts upon the shrubs and trees peculiar to them; for instance at Mussooree it is found upon *Bradleia ovata*, *Falconeria insignis*, and several others; at Almorah the yellow flowering Barberry is said to be its favorite food, although singularly enough I have at Mussooree never succeeded in making it eat the leaves of that shrub. In Cachar again it feeds upon other trees, and in Java, according to Dr. Horsfield, upon the Molokha (*Phyllanthus emblica*) *Kupu-gaja* &c. while Lady Rose Gilbert succeeded in rearing it on "the apple, peach, and plum" trees.

At Mussooree the moth comes forth in the end of June, and deposits its eggs upon the leaves; these are not piled up

pyramidally like those of the two preceding species, but are sometimes found in a row side by side, touching each other to the number of three or four; sometimes at short distances from each other, and again either singly or in pairs. The egg is often infested with a small fly which Mr. Moore has declared to be new to science. When the fly is ready to come forth it cuts a small circular hole at one end and sallies forth, but how it manages to enter the egg it is difficult to say, as I have been unable to detect the slightest orifice even with the aid of a strong lens.

Caterpillars produced from eggs deposited on the 4th July, hatched on the 14th of the same month. At first they have the head and prolegs of a shining jet black; body also black, with a broad white dorsal stripe, beginning at the second segment and running back to the anal one; each segment is ringed with a raised white transverse ridge, from which spring six rows of slender fleshy tubercles, crowned by tufts of hair; these tubercles are disposed in two dorsal and two lateral rows on each side.

On the 21st July, when seven days old, the first moult was completed, and the appearance was then,—head brown; body beneath black; above white; each segment armed with a raised transverse ridge from which spring the tubercles, which are now long and cylindrical without the apical tufts of hairs; the three anterior tubercles on each side belonging to the lower lateral row are now black with white tips, as are also those on the 10th and 11th segments; a pale reddish brown, or coppery spot on the side of the 4th, 9th, and 10th segments. The body and tubercles thickly loaded with white powder, which is evidently secreted from the skin, as when the moult has just recently occurred there is none. Prolegs black; when at rest, the caterpillar has a curious habit of curling itself round into a horse-shoe shape.

On the evening of the 26th July the second moult occurred; and in this, the third stage, the colour is white as before,

the lower lateral row of tubercles being now nearly all black, and sprinkled over with white powder; head pale brown; a lateral red spot on 4th, 9th, 10th, and 11th segments; a faint pinkish or flesh coloured tinge on the border of the anal foot. The tubercles of the anterior segment project, as previously in the other stages, over the head to the front. Stigmata white. The anal shield or plate has a faint blue tinge.

On the 31st July the third moult occurred. The body is now faint sea green, seen through a thick veil of white powder, and the tubercles are much longer in proportion, and slope backwards until the animal is disturbed, when they are suddenly elevated like a porcupine's quills; the lower lateral row of tubercles is now all black; a brick red ovate ring on the side of the anal foot; a transverse livid black bar on the true legs; anal segment and body generally spotted over with dark livid spots; prolegs alternately barred with black and white; anal shield very thick and gibbous at the borders, which are rounded and have a tinge of blue; head and legs pale sea green; the tubercles of the anterior segment project forward as before, and those on the 2d, 3d, 11th, and 12th segments are now retracted to mere rounded knobs; between those of the anterior segments, occur short, longitudinally directed, black dashes.

On the 6th August the fourth moult was completed. In this stage there is no perceptible difference except in size, and in increased brightness of colours; a narrow black border to the anal feet.

On the 24th August, or 42 days after exclusion from the egg, being now rather more than five inches long, the caterpillar began to spin on a leaf of *Falconeria insignis*, upon which plant it had been reared.

It commenced by first winding successive threads around the stalk of the leaf and the stem of the twig, so as to prevent its becoming detached in the winter when the other leaves fall and at which season the cocoon is thus readily detected as i

hangs solitarily from the branch. When this safety rope has been firmly fixed, it next proceeds to weave a strong web upon the surface of the leaf, and having done this it fastens a thread to the edge of the leaf, and then, by drawing this tightly across to the opposite side, causes the two edges to curl or fold inwards; a web is then rapidly spun from side to side, so as to form a strong silken bag upon the leaf, in which the insect gradually envelopes itself and forms the true cocoon. When the whole is finished the cocoon has a long, pear shape, the upper and narrower end being left partially open for the egress of the moth, which has merely to push its way through.

This species is so well known that it would be superfluous to describe it here, and I shall therefore content myself with pointing out that there are great differences in the size and brightness of the colours; those from China and Cachar being of a much more roseate, or pale red, hue than those of Mussooree, which are very dark. The expanse of wing in the male runs from $10\frac{1}{4}$ to $10\frac{1}{2}$ inches, and of the female from $10\frac{1}{4}$ to 11 inches.

Plate 1. fig 4, is a tolerably correct representation of the larva in its last stage, and Pl. 2. fig. 2, is the cocoon.

The last species now to be noticed is one which is apparently known only from one or two specimens found in the collection made by the Messrs. Schlagentweit at Darjeeling, and others more recently acquired by Dr. Jerdon and Major Atkinson of the Indian Army. It was described and named by Mr. Adam White of the British Museum, in the proceedings of the Zoological Society for 1859, and stands as.

4 *Attacus Edwardsi*. (White.)

Attacus Edwardsii White, P. Z. S. (1859) p. 115
 pl. 57; Moore Cat. Lep.
 Mus. Ind House ii. p. 406.

This species I have not yet seen, though the coloured drawing, furnished through the kindness of Mr. Moore, leaves no room to doubt the entire distinctness of the insect from the

last. According to the description given by Mr. Moore in his pamphlet on the Indian Bombycidæ, "this species is distinguished from *Attacus Atlas* by its intensely dark colour, especially on that band, bounded by angled and curved white defined lines, in which the fenestræ occur. This band is of a dark blackish brown, passing into a rich chestnut brown above the fenestræ of the upper wings and on their posterior margin; the inner margin of the lower wings is of this red brown also; the fenestræ are not bounded by a margin of black scales as in *A. Atlas*, but by ochreous yellow squamulation; the part of the fenestræ towards the base of the wings, which in *A. Atlas* is curved convexly, is in *A. Edwardsi* straight; the fenestra is longer, the white lines on the wings, breaking up the brown so beautifully, are wider, and that on the lower wing is less scalloped than in *A. Atlas*; the margin of the lower wing on the outside has two much waved lines; the inner is yellow, with thirteen or fourteen undulations, continued on the upper wing till it leaves off where the wing is dilated into the lobe which gives the wing its hooked character; the lower line is brownish black, and is straight, except in six places where the black runs up the nerves triangularly to a point, and meets two of the yellow lobes, which are conjugate."

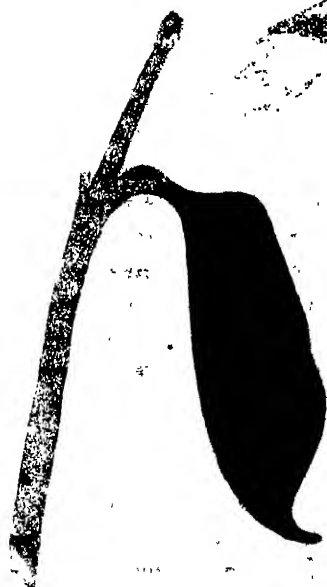
The statement that the part of the fenestra which is turned towards the base of the wings is in *A. Atlas* "curved convexly,"—is not always to be depended upon, as I have specimens of Mussooree *A. Atlas* in which that part is slightly convex, while in others it is straight, and in two males, one from Cachar, the other from Almorah, the fenestra of the upper wings are straight, and in the lower wings *concave*.

Of the larva and cocoon of this species I have received no information whatever, and would therefore urge upon those who are repairing this season to Darjeeling and who take an interest in the subject, the necessity of searching for, and noting, the peculiarities of the larva.

THOMAS HUTTON, F. G. S.

PLATE. II.

FIG. 1



1 ATTACUS CYNTHIA.
COCOON.

FIG. 2.



2 ATTACUS ATLAS.
COCOON.

Further Report on the sowing of Exotic Cotton Seed distributed during 1861.

[In continuation of the Report published in pages 212 to 264 of vol. xii.]

OUDE.

The following is an interesting extract from Dr. Bonavia's letter dated Lucknow 15th May:—1862.

"I have this day despatched, per dawk banghy, two samples of cotton grown on my experimental ground. One of them is New Orleans. This specimen is of the second crop from the same plants, specimens of the cotton of which I sent you a short time ago. That was of the winter crop, this is of the summer crop. After the first crop was gathered, I cut down the plants, leaving about two feet of the principal stem, and lopped off all the branches, and began to irrigate at intervals of five or six days, and afterwards about every fourth day when the hot winds began to blow;—the result was that the plants, having the benefit of a large number of roots, threw out healthy branches and flowered profusely at the commencement of the hot weather. I assure you it was a sight to see the plot one mass of flowers. They are now laden with bolls and are ripening; the specimen I now send you is of this gathering. Soon after, I cut down the plants, and before I commenced to irrigate, I gave each a top dressing of rotten manure. In this summer crop there is scarcely *one* boll injured, and as you will see the fibre is not discolored."

In a second letter, dated 25th May, alluding to the despatch of a second sample of cotton from New Orleans stock, Dr. Bonavia offers a few more remarks:—

"These are some bolls of this summer crop, New Orleans, which was sown in June 1861. After the first crop, I cut down and irrigated every fourth or fifth day; they are now ripening their bolls with which they are covered: all the bolls are good, that is none of them are spoilt, and there is a large proportion of five-valved, of which the present are specimens. Some days ago I sent you two specimens: that of New Orleans was from four-valved bolls. What I wish to know now is,—whether you can find any difference be-

tween the staple of the four-valved which I have already sent you, and that of the five-valved which I *now* send you—and if any, what difference? When I shall have gathered this crop, I shall furnish you with a small report. Some natives to whom I showed the present crop were very much pleased, and after studying the way in which mine is planted, they asked for some seed, which they got, and promised to estimate its value per beegah, when they get the cotton out of it.”

In his first letter Dr. Bonavia also refers to the cotton raised by him from Berar seed:—

“The second specimen is from the summer crop of Berar cotton raised from the seed you sent me last year. As it reached me late in the season, it did not flower then, but has flowered now for the first time. The ground for the latter was only ploughed and slightly manured. In my opinion, there is not the slightest difficulty in growing very good cotton in Oudh. It only requires a little trouble in preparing the ground and in irrigating the plants during the hot weather. There is no doubt that much better crops can be obtained by cutting down the old plants and irrigating during the hot months. I have already sown my new crops, the plants are about two inches high, and I expect them to be one foot high before the regular rains set in.”

The Secretary mentioned that, in the opinion of Messrs Douglas and Haworth members of the Committee, the summer crop of New Orleans cotton is fully equal to the winter crop, which they had previously reported on so favorably (Journal, Vol XII. page 261), and that there is no difference perceptible between the cotton in the four and five-valved bolls; the result is altogether very encouraging. In respect to the third sample raised from the seed (probably of *Gossypium arboreum*) which Captain Davis had sent last year to the Society, the Committee are of opinion that it is a decided improvement on the original stock, which was reported on in April 1861 (Journal, Vol. XII. page 125,) the color being equally good, and the fibre soft and silky, instead of being harsh like the sample received from Captain Davis; the extended culture of this description of cotton might therefore be desirable.

The Secretary further mentioned that on receipt of the second

letter he had applied to Dr. Bonavia for some information in respect to the exact mode of pruning and plucking he had adopted ; and he had replied thereto,—

“ In pruning my New Orleans cotton plants for the summer crop, I cut down the main stem half way, or a little higher than half way, —and the branches I lopped off just above the lowermost budding joint, or axilla. I then removed some of the earth from near the root of the plants, gave them a top dressing of rotten manure, and replaced the earth, leaving a channel for water on each side of the row of plants. I watered about every four or five days. The pods I allowed to ripen on the plant ; they burst on one day, and I collect the cotton on the evening of the next. If the rains had commenced early this year, probably, I should have plucked the pods as soon as they began to burst, but in no instance have I yet done so ; and my opinion is that if natives pluck the pods also, they will never produce clean cotton. I get the collectors to make the dhotee in the shape of a bag and go round each evening a little before sun down and collect the cotton out of the pods, leaving the latter on the tree.”

DR. BONAVIA'S *Report on the Second or Summer Crop of Foreign Cotton raised from seed supplied in 1861, at Lucknow.*

In order to make this report more complete, I shall recapitulate briefly, as suggested by the Secretary of the Agri-Horticultural Society of India, what I said in my first report.

The New Orleans and Egyptian Cotton seed, received from the Deputy Commissioner and the Secretary to Chief Commissioner of Oudh, was sown about the end of May 1861 as follows :—

I sowed a portion of each kind of seed (in rows about 4 feet apart and by threes at a distance of 2 or 3 feet.) on trenched ground with manure, and a portion of each on simply ploughed ground without manure. The New Orleans germinated very sparingly on both plots, so that I only saved 290 plants on the trenched ground and 100 on the ploughed ground. The Egyptian almost all germinated, and of the latter, after thinning out the plants as they grew, I had 242 on the trenched and 210 on the ploughed ground.

In twelve weeks from the time of sowing, the plants were in flower, and averaged from 4 to 5 feet high and 3 to 4 feet across. Those on the ploughed ground were somewhat smaller. All the plots were irrigated at intervals, when necessary, till the heavy rains began, and weeded occasionally when young. The fall of rain in 1861 was extraordinary, and nevertheless I lost no plants, although my plots of ground, with regard to drainage, were very unfavorably situated. This I attribute to their having been a few inches above the ground when the heavy rains began to fall. Almost all the bolls were more or less injured by maggots, the generation of which may have been greatly favored by the excessive fall of rain.

I sent various samples of the product to the Agri-Horticultural Society of India, of all kinds, good, bad, and indifferent, and the opinions of Messrs W. Haworth and Stewart Douglas regarding the samples were very favorable. The latter reporting on the quality of the small number of bolls that were untouched by maggots, says:

(New Orleans No 1 Good bolls) "This is by far the best produce that I have seen of this stock grown in India. The bolls are unusually large some of them with 5 valves, and all well filled, and have been carefully plucked at the proper time. The cotton is nearly equal to fair middling New Orleans, and worth 1st March 1862 in England (cleaned) fully 12 to 13 pence per lb."

The other samples of New Orleans were inferior, the bolls having been injured, before maturity, by maggots.—

(Egyptian No 1 Good bolls) "This cotton maintains its original character for softness of texture, and is of fair length of staple. The fibre, I find particularly strong and it is a most desirable description of Cotton to cultivate, and worth in England fully 12½ pence per lb."

The other samples were much inferior from causes previously alluded to. Further particulars regarding the samples of Cotton and my experiments on hybridization &c. will be found in my original report published in the Society's Journal Vol. XII part II page 220.

I kept no account of the proportion of staple produced by the first crop of the plants I saved, owing to the injury by maggots

having been very extensive. I considered that the experiment was so far successful, inasmuch as the plants that germinated, with ordinary care, flourished, and produced a considerable number of bolls,—and the staple of those that were uninjured was very satisfactory in the opinion of competent judges.

I did not destroy the plants, but towards the end of the winter, when I observed that both the New Orleans and Egyptian were inclined to throw out new shoots, I cut them down to about 2 or 3 feet from the ground and lopped off all the branches a little above the lowest budding joint. A little of the earth from near the roots, was scraped away, and some top dressing of rotten manure was mixed with it and the earth was replaced, leaving a channel on each side of the row of plants for the purpose of irrigation. They were irrigated every 4 or 5 days* throughout the summer. New shoots were thrown out, and about the middle of April, they were so covered with flowers, that it was a sight to look at them. About a month after, the second or Summer crop was ripening. In this crop the leaves and branches were not many, but the flowers were profuse. Of the New Orleans *scarcely one* boll was injured by mag-gots, and of the Egyptian a very small proportion was injured. The whole of the New Orleans crop was ripe and gathered before the rains of 1862 commenced. But the Egyptian continued to flower for a long time and consequently a small proportion of bolls had not ripened when the rains commenced, and of course those were lost. The method I adopted in gathering the cotton is as follows. The boll bursts on one day and the Cotton is gathered on the evening of the next day. A man makes a bag of a part of his *dhotie* and gathers the cotton in it, leaving the shell on the tree. I am certain that if natives gather the shell also, they will *never* produce a cotton sufficiently clean for the English market, while following this method, it is as clean as can be wished. With regard to the quality of the produce of the *second crop* it is, as far as I can judge, superior to that of the *first*. The proportion of 5-valved bolls is by far greater than in the previous crop and the bolls are all uninjured—I have appended the report of the Calcutta Cotton Committee on the samples of the second crop, which, as will

* Once a week is quite sufficient.

be seen, is very favorable. With regard to the quantity produced in this crop, the following is the result. The number of original plants are in all 890, of which 100 are on simply ploughed ground. The total produce of the 890 plants of N. O. second crop is 45 lbs. of seed, and $21\frac{1}{2}$ lbs of clean staple, which is about *one ounce* of clean cotton per plant—The 890 plants occupy 8 *pucca biswahs* of ground, which would give at the rate of upwards of 52 lbs of clean cotton per *pucca beegha*. This crop of New Orleans cotton has produced 32 per cent of staple—the rest seed.

450 Plants of Egyptian Cotton (of which 210 are on simply ploughed ground) produced in the summer Crop 12 lbs of seed and 5 lbs of staple, or an average of about *one ounce* of clean cotton to every 5 plants. The plants occupy 8 *pucca biswahs* of ground which would give at the rate of 12 lbs of clean cotton per *pucca beegha*.

This crop of Egyptian Cotton has given 30 per cent of fibre, the rest being seed.

These same original plants, both New Orleans and Egyptian, so soon as this year's rain began to fall, threw out a large number of branches (without the aid of ~~stapling~~) and are now very fine and large bushes, flowering freely and producing a large number of bolls. It remains to be seen whether the produce of the second year, will equal that of the first. Besides continuing the experiment on the original plants, I have made this year a variety of others, I have sown about $1\frac{1}{2}$ *beeghas* of N. O. acclimatized seed. It is some of a lot procured from Shahjahanpore by the Secretary of the Agri-Horticultural Society of Oudh. The method of sowing adopted, is the one I suggested in my first report *viz.* instead of trenching the whole ground I dug parallel trenches, 18 inches wide and 18 in. deep and 4 feet apart, and re-filled them with a mixture of earth and small proportion of rotten manure. I sowed the seed in the middle of the trenches, about the beginning of May last, that is more than a month before the rains commenced, and irrigated every 3rd or 4th day. They only had grown to about the height of a foot when the rains began to fall. After that, they grew rapidly and are now large and healthy bushes covering the whole field and covered with flowers and bolls.

(About the same time as the above, I sowed and treated in like manner, about half a beegha of Nankin Cotton, the seed of which I procured from Malta. About *half* of this seed only germinated. Of another variety of white Cotton seed also procured from Malta only 3 seeds germinated.) I have also sown *broadcast* two beeghas of my own acclimated seed, having prepared the ground by simply digging it up by *phawrahs* 15 inches long in the blade. One beegha of which was sown after the commencement of the heavy rains and one later. *Every* seed germinated. They are doing well, but the heavy rains falling on very young cotton plants retards their growth immensely, unless the ground have a gentle slope to carry off the superfluous water. I shall be able to irrigate these plots in the hot weather of 1863 by dividing the ground into beds by ridges. In sowing broadcast the seed should be rubbed up with fresh cowdung and allowed to dry. By this means the short down of each seed becomes plastered together, and so, when dry, the seeds easily slip out of the sower's hand.

I have further made several experiments on small quantities of seed of different kinds of Cotton that presented qualities which promised good results by acclimatization and cultivation. Of these for the present I shall not say anything.

It may perhaps be wished to know what became of the *hybrids* mentioned in my first report. I sowed the seeds of two hybrid bolls (New Orleans on Egyptian.) They germinated and produced very fine plants, having the general character of the Egyptian, but certain characters in the leaves and flowers indicate their alliance to the New Orleans Cotton. After some time, almost all the leaves dropped off. They are still alive and producing new leaves. One of them flowered but gave no fruit. It is possible that they are barren. However more about them hereafter.

This closes my account for the present of the Foreign Cotton.

In 1861, I received a small quantity of Berar Cotton seed (*Gossypium Arboreum*) from the Secretary to the Agri-Horticultural Society of India for trial—I sowed it on trenched ground. It grew very well and produced bushes 4 and 5 feet high. I had a 100 plants; irrigated them during the hot season of 1862, and they produced an abundant crop. They were not pruned. At the end of this

report I have appended the opinion of the Calcutta Cotton Committee of the samples of Berar Cotton I forwarded them.

100 Plants, occupying two *pucca biswaahs* of ground, produced in 1st Crop (summer) 10 lbs of seed and $3\frac{1}{2}$ lbs of fibre or about $\frac{1}{2}$ an ounce of clean Cotton per plant. It produced at the rate of 35 lbs of clean Cotton per *beegha*. This crop gave 26 per cent of fibre the rest seed.

In conclusion I have an economical suggestion to make, with regard to preparing the ground for foreign or other Cotton, in case natives should take up its cultivation. Villagers in Oudh grow sweet potatoes (Gunjee or Shukurkund) plentifully, and they consider it a paying crop. It is planted during the rains, after preparing the ground by digging and manuring. In October they commence to dig up the sweet potatoe crop, by means of a *phowrah* or *kodar*, leaving the soil loosened to the depth of 15 or 18 inches. So that the operation for *gathering* the produce of the sweet potatoe crop is exactly the one required for the growth of Cotton. I have no doubt that in a rotation of crops, Cotton might, with economy and benefit succeed *Gunjee*.

The seed resulting from last summer's crops of Cotton, I distributed as follows. *New Orleans* 45 lbs.

18 lbs sown in Badshahbagh in different ways for a second experiment.

25 lbs sent to Major Orr, Roy Bareilly, for distribution among his villagers.

2 lbs to Mr. Glynn, Deputy Commissioner, Roy Bareilly.

Egyptian 12 lbs.

12 lbs to Major Orr, Roy Bareilly.

Berar 10 lbs.

6 lbs sown in Badshahbagh broadcast for a second experiment.

$3\frac{1}{2}$ lbs to Major Orr, Roy Bareilly.

$\frac{1}{2}$ lb to a village in *Dharumnuggur* near Gonda.

Besides, I distributed a large quantity of Egyptian seed (given to me by Dr. Cannon) among the villagers of the above named place, as also a small quantity of acclimatized New Orleans seed. Several of those villagers have now some *biswaahs* each of Foreign Cotton which is growing and is in good condition.

Table showing result of Summer Crop of 1862.

Kind of Cotton.	No. of plants		Aggreg. amount of Staple.	Per centage of Staple.	Proportion of Sta- ple per plant.	Proportion of Staple per beegha
	Trenched ground.	Untrenched ground.				
*New Orleans imported,	290 5 biswas.	* 100 3 biswas.	21 lbs.	52 p. c.	1 oz. of clean cot- ton per plant.	Upward of 52 lbs. of clean cotton.
Egyptian imported,	242 5 biswas.	210 3 biswas.	5 lbs.	30 p. c.	1 oz. of clean cot- ton to 5 plants.	12 lbs. of Do.
Barar indigenous,	100 2 biswas.		3½ lbs.	26 p. c.	½ oz. of clean cot- ton per plant.	85 lbs. of Do.

* These 3 biswas had not the full proportion of plants. The N. O. germinated very sparingly and I had no more plants to fill up the space. 174 would be about the proportion.

With regard to the expence of growing Foreign Cotton, I can as yet say nothing. But in my opinion it will not be more than for growing the usual crops, especially if sown after Gunjee, and I have little doubt that it will pay provided its irrigation during the hot weather can be easily effected.

N. B. The fibre of the New Orleans Cotton can with great difficulty be separated from the seed, by means of the native *Churka*, and that only in very dry weather and with a very well made machine.

LUCKNOW :

12th September 1862.

G. M. T. BONAVIDA, M. D.

Opinion of Mr. Haworth member of the Calcutta Cotton Committee, on the Samples of cotton mentioned in the foregoing report.

No. 1 Wool only, from New Orleans seed (grown in trenched land) and from second crop plants that had been pruned and irrigated.

"The color and condition of the cotton are very good. The staple is just the length of middling Orleans, and it is of fair strength.

Its ordinary value is about $7\frac{1}{2}$ d., but early in August 1862 it would have fetched $18\frac{1}{2}$ d. I may observe that I can perceive very little difference between this and the following sample, said to be grown in *untrenched* ground, and I think it is probable that it has felt the effect of the *poorer* subsoil having been brought to the surface. If trenching is carried out, it should be done effectually, and not less than 2 feet 6 inches deep, the surface soil to be kept separate, and afterwards to be thrown into its original position. It is only when the plant is intended to be grown in its natural condition as a *perennial*, that it would afford this extra expense, and which would tell in the second and third years, unless stagnant water was present below. Instead of trenching, subsoil ploughing would be better, but then elephant or steam power would be required for the purpose."

No. 2 Wool only, from New Orleans seed (grown in the untrenched land) second crop from pruned and irrigated plants.

"This appears to be in every respect the same as No 1; or if any thing somewhat softer, Value same as No. 1."

No. 2½ Wool, from Egyptian seed grown as the above. "This is rather stained in color, but not much worse than the average of what is received from Egypt. It is fairly clean, staple equal to original Egyptian in length and softness; value ordinary, about 8½d. in August 1862, 19d.

No 3.—Wool from Berar seed (first crop.)

"The color, cleanliness and general condition of this sample is very satisfactory: the staple is nearly equal in length to middling New Orleans, and quite equal in every other respect, and rather cleaner than a sample of the approved *Darwar* I have just received from Bombay, ordinary value 7d. in August 1862, 16d. to 17½d. This is a very useful cotton, and too much of it cannot be grown."

No. 4.—Wool on seed, from New Orleans seed grown on untrenched land.

"This is a very nice sample, in excellent condition, and very silky. It confirms my previous remark that the sample of the New Orleans grown on untrenched land was softer than the produce of trenched ground.

No. 4½.—Wool on seed, from Egyptian seed.

"The only remark I can make on this sample is, that the seed is not of so dark a black color as is usual, and when taking the cotton from the bolls more care should have been given to separate the stained portion which is very weak and spoils the good."

No 5.—Wool on seed, from Berar seed.

"This is also in good condition, the seed is well matured, and unusually large for native growth."

No 6 and 7—Seed only, New Orleans produce of trenched and untrenched land.

"The only difference I can see between these two samples of seed is, that there is more wool adhering to that grown on trenched, than I find on the seed from untrenched ground."

No. 7½.—Seed only, Egyptian. "Very fair, somewhat light in color as if not thoroughly matured."

No. 8.—Seed only, Berar first crop.

Very fine and well cleaned, every grain of such seed should be preserved, and most carefully sown in suitable soil, and well cared for throughout its growth, and the best of its produce kept for

future use, for the much desired view of obtaining a supply of superior native or indigenous seed of known superior kind.

More rapid improvement in the staple of Indian grown cotton may be looked for in this way than from the introduction of exotic kinds, which will require much time and perseverance."

No. 9 and 10.—Bolls from New Orleans, 4 and 5 cells, from trenched land.

"These are as fine and as well grown as could reasonably be expected, or ever realized on large scale."

No. 11.—Bolls from Berar seed—1st. Crop.

"These are fully as good as any bolls I have ever seen from native seeds"

P. S. I observe that the crop of cotton is the one that ripens in the hot season (about April, and May.) The plants sown in the rains grow and produce a large number of leaves and here and there flower. After the rains, and about November and December the plants become covered with flower buds the fruit of which ripens in the ensuing hot months and is the real and profitable crop. A few waterings at the flower-budding season (Novr. and Decr.) and a few more at the ripening season (April) with an occasional intermediate watering, where possible, will produce wonderful effects.

The flowering and ripening occur at the same periods in the New Orleans, Egyptian, Berar, and another native kind called *Manwah*.

The New Orleans and Egyptian produce a small proportion of bolls during the rains which are always more or less injured and the fibre of which can be profitably made use of for quilts and native wearing apparel adapted for the ensuing cold weather.

G. B.

The following is the result of an analysis made by Mr. A. Tween of the Lucknow Cotton Soil received from Dr. Bonavia, and referred to at the Monthly Meeting of 18th November, 1862.

Organic Matter.....	.....	.....	.....	.....	4.0
Water.....	.....	.....	.....	.....	0.2
Oxide of Iron.....	.....	.....	.....	.....	1.4
Alumina.....	.....	.....	.....	.....	6.1
Silica and Clay (Insoluble)...	.....	.....	.....	.....	9.0
Residue—a little Lime, Magnesia, and Alkali (Chlorides)...					0.8
					<hr/> 100.0

The following Report of the Cotton Committee on some Samples of Cotton, &c., was presented at the November meeting, of the Society:—

No. 1.—Cotton from New Orleans seed, grown in Lucknow Jail Garden, and of Thread and Table Napkins manufactured by the prisoners.

“I have examined the Cotton said to be grown in the Lucknow Central Jail Garden from imported New Orleans seed. The color and condition are good; it appears to have been cleaned and bowed, and the latter operation causes it to be somewhat nappy: the staple is of the same length as ordinary New Orleans, and about as strong.

Twist.—The Twist said to be handspun from the same Cotton is exceedingly even, and the chequered Napkin woven from it is a well-made strong article.

Any quantity of such like Cotton-wool would meet with ready sale.

(Sd.) W. HAWORTH.

No. 1.—I quite agree with Mr. Haworth in his remarks upon No. 1 sample of Cotton, and upon the Twist and Cloth.

(Sd.) W. S. FITZWILLIAM.

“I have examined the sample of Cotton, Cotton Yarn, and Cloth, sent to me by the Agricultural and Horticultural Society, and beg to send you my report on them.

Cotton grown in Lucknow Jail Garden from imported New Orleans seed.

This is a very useful description of Cotton; clean and of good color; of fair length of staple and strong fibre. The process of “bowing” has somewhat deteriorated its commercial value by injuring the staple and creating more “fly” and “waste” than desirable.

Twist.—This is said to be spun from the above Cotton, and it is a very creditable specimen of Jail industry, being very even, clean and strong. It would count between 30s. and 34s.; its present value is about eight annas per morah, equal to rupee 1-8 per seer.

Cloth.—The Table Napkin woven from the above Yarn is also very creditable to the manufacturer.

(Sd.) ST. DOUGLAS.

ROY BAREILLY. OUDH.

The following is a letter from Major A. P. Orr, of Roy Bareilly, in continuation of a previous letter on the subject of cotton culture:—

“In my letter to your address, dated 9th January 1862, on the subject of the sowing of exotic cotton seed (*vide* Journal, Part II., Vol. XII. page 218) I mentioned that I should allow such of the plants grown in 1861, and which had escaped from the ravages of insects and the effects of the excessive rain of that year, to stand another year, in the hope that they might throw out a second and better produce. At the close of the last cold weather I pruned the plants, and small and impoverished as they are, owing to causes above alluded to, the present hot weather crop has surpassed my greatest expectation. The crop has been, comparatively speaking, plentiful, and as far as I am able to judge, of a fair quality. I send you samples of bolls and of extracted cotton.

“I am now preparing to sow some seed (N. O.) produced in my garden, and also some Egyptian, New Orleans, and Berar seeds kindly forwarded to me by Dr. Bonavia, of Lucknow; the result shall be duly reported to you.

“I must not omit to mention that during the late hot weather season I sprinkled the plants with a strong decoction of tobacco leaves, in order to destroy, if possible, the insects with which they were infested, and I think that the plan was in a measure successful.”

BALASORE.

The following letters accompanying a sample of Balasore Cotton from Mr. Cornell, were read at the November Meeting of the Society.

“1. With reference to your letters, of the 10th October and 18th December 1861, I have the honor to state that the Egyptian Cotton seed received from the Society was distributed among the landholders and other residents, and to the Rajahs of the Hill States of this district.

2. The Deputy Collector of Bhuddruck reports that the seed distributed among the landholders in his Sub-Division did not vegetate, the soil of that Sub-Division not being good.

3. The Rajahs Mohourbhunge and Neelghur have not reported the results of their sowings: but one landholder, Baboo Paddum Lochun Mundul, planted $1\frac{1}{2}$ seers of seed, and states that several of the plants produced cotton, and the whole quantity for this season is one seer, on account of the trees being young, but a better crop is expected next season. A specimen of his cotton is forwarded herewith, although it seems, so far as I can judge, that the generality of the landholders are not eager for, nor equal to the cultivation of a plant requiring careful watching and some deviation from their regular system; yet I have no doubt that there is much land in the district in which Cotton might be grown under proper superintendence, and I enclose a copy of a letter from Mr. A. Bond, one of the oldest residents of this station, whose experiments in this line have frequently been successful.

4. I cannot recommend the Society forwarding a fresh supply of seed, as I think the landholders ought in future to be left to procure it for themselves."

From, A. BOND Esq.

Master Attendant Balasore.

To W. CORNELL Esq

Officiating Collector, Balasore.

SIR,—“1. I have the honor to inform you, in answer to your letter, No. 482, relating to the growth of Cotton in this district with Egyptian seed, that it thrives well and rises to the height of 8 feet, producing a good crop with a spread of 6 feet on high lands, above the inundation, and continues to thrive for three years, when the trees will require renewing; and lands now fallow and yielding no revenue, on account of its being too sandy, would, by digging holes and filling them up with manure, produce Cotton, thereby benefiting the Government hereafter in revenue. The yield I have not quoted, but will this year, as I have now about 40 trees* remaining. Black soil on high land is of course the best.

* Giving two crops and now in blossom.

2. With respect to the sanction by the Deputy Governor, dated the 12th February 1862, No. 141A., in the 2nd paragraph, to my receiving Purreeah lands for the purpose of planting Cotton, but at the same time not permitting me, as a servant of Government, to superintend the work: I have therefore given it up.

3. All high lands with proper manure will produce this Cotton, but it requires care in keeping cattle from it, and carefully weeding and watering it. I have some plants, three years old, yielding well, which require the branches to be lopped in the rains to give them strength to flower."

Report of the Cotton Committee.

Sample No. 2.—Cotton grown by a landholder in the Hill Districts of Balasore by name Puddo Lochun Mundul. This is rather too small a sample to report on satisfactorily, but it is a very desirable description of Cotton in every respect, and, as such, every encouragement ought to be given to its cultivation. It is exactly from such parties that we have, in my opinion, to look for every important improvement in the cultivation of Cotton in India, and to them, therefore, we ought to give every encouragement and support. The grower ought to be informed that his sample, if cleaned, would be worth 24*d.* per lb in Liverpool at present."

(Sd.) ST. DOUGLAS,

No. 2 Sample, from Egyptian Seed.

Cotton said to be grown from Egyptian seed by a landholder in the Hill District of Balasore.

This is a mixed sample. The color and condition good; staple is irregular in length; and on the whole shorter and weaker than fair Egyptian.

(Sd.) W. HAWORTH.

The sample No. 2, is so small and mixed that it is difficult to form an opinion on it.

W. S. FITZWILLIAM.

BURMAH.

Six samples of Cotton, the produce of the Experimental Cotton Cultivation at Rangoon, in 1861-62, under the superintendence of Dr. Brandis, were presented by the Government of India. These were accompanied by the following report from Dr. Brandis, to the Secretary to the Chief Commissioner of British Burmah, dated 28th June 1862 :—

"I have the honour, for the information of the Chief Commissioner, to report on the experimental cultivation of Cotton, in 1861-62, as follows :—

"In last year's report it was stated, that it was intended to abandon the cotton garden at Rangoon, and to carry on the experimental cultivation near Myodwin only.

"2. The locality near Myodwin is situated near the village of Nyoungneehin, on the banks of the Bobin stream. The ground was formerly subject to inundation, but the bed of the Bobin stream having deepened, it is dry now. The soil is a dark grey sand. The place was covered with a dense mass of elephant grass *Saccharum procerum*, *Saccharum sarā*, and other species in many places from ten to fifteen feet high.

"The preparation of the ground consisted in clearing away the elephant grass and weeding the field whenever required. Four acres were thus prepared. This was done in May and June.

"In July the sowing commenced.

"The following varieties were sown :—

First, New Orleans seed (second season). This seed was raised at Nyoungneehin in 1860-61, from seed received from Calcutta in 1860. The produce of this variety in 1860-61 was reported on by me in May 1861, and a sample sent to the Agri-Horticultural Society was reported upon by the Cotton Committee on the 30th October 1861.

"This seed was sown in the early part of July in one acre. It came up well. By the first of August, the plants were upwards of a foot in height and in a healthy condition.

"In October, just before the plants came into flower, the soil around each plant was loosened and heaped up round the base of the stem.

"The pods commenced to ripen in November, but, unfortunately at that time heavy showers of rain fell which did great harm to the fibre.

"The picking began about the 10th December. The operation was continued till the early part of April, but in March the yield was the largest. The cotton was ginned in common country gins, the produce was 360 lbs.; of this 120 lbs. were cotton and 240 lbs. the seed. This is at the rate of 120 lbs.; clean cotton per acre.

"*Second, Sea Island seed (second season).* This was likewise seed of last year's produce from a field near Myodwin. Half an acre was sown at the same time with the New Orleans seed, the plants came up well, rivalling at first those of the New Orleans seed, but they were longer in coming to maturity, and were much affected by the heat of the dry season. The out-turn of this variety has been an almost entire failure, only seven pounds of cotton with seed having been obtained; combining this with the out-turn of the same kind in 1860-61, it would appear that the circumstances under which this description will thrive, if cultivated in a large scale, have not yet been discovered here.

"*Third, Egyptian and Fourth New Orleans,* received from the Secretary, Agri-Horticultural Society in June 1861. This seed reached Myodwin on the 29th July, too late in the season. It was sown in August, on two acres and a half. Part of the seed germinated; the number of plants raised was but small, and although they made good progress to the end of November, they were unable to stand the long continued drought after that time; they have yielded no cotton at all.

"3. Burmese coolies have been the sole agency employed in this cultivation. The head man was a cultivator of the neighbourhood.

"The expense has been as follows:—

"Pay of head man (at Rs. 15),	...	...	Rs. 180	0	0
"Cooly hire for clearing, sowing, digging, picking, ginning, &c.	...	...	...	895	0
				<hr/>	
Total Rs.				575	0

whole, the experiment of this year has not been

favourable, yet experience has been gained and a quantity of acclimated foreign seed has been made available for distribution; therefore as long as the expense remains within the above limited amount, it does not appear advisable to discontinue the trial.

"4. The following is a list of samples sent with reference to this report:—

"Sent on 25th April, New Orleans, 2nd season, 6 lbs. with seed.

"Ditto ditto ditto, with seed 5 lbs. 7 oz.

"Ditto 28th June ditto, without seed 80 lbs.

"Ditto ditto Sea Island, a small quantity."

The samples and report were referred to the Cotton Committee.

Report of the Cotton Committee.

Nos. 1 to 4.—Four out of six samples from Dr. Brandis's Experimental Garden at Rangoon. These are said to be from New Orleans seed, and their general condition is fair, but the staple is irregular and scarcely any of it is quite equal in length to middling Orleans; it is also weak, but very soft.

Nos. 5 and 6.—Appears to be a mixed sample, as I find a few black seeds amongst the rest which is more like an upland Cotton than Orleans. Sample 6 comes nearer to Sea Island in color and softness, but the staple is far short.

(Sd.) W. HAWORTH.

Nos. 1 to 4.—Clean and good staple—would sell well in Liverpool.

Nos. 5 and 6.—Staple excellent, would rank with best Egyptian.

(Sd.) W. S. FITZWILLIAM.

Nos. 1 to 4.—Samples of Cotton grown from acclimated New Orleans seed of the second season. These are of good quality for the species, and do not seem to have deteriorated much; they are well cleaned, although here and there showing a little stain. The staple is soft but weak.

No. 5 on seed.—Seems to be the same Cotton as the above. It is certainly not Sea Island Cotton.

No. 6.—May be from Sea Island seed, but if it is, the quality of the produce has very much deteriorated.

(Sd.) S. DOUGLAS.

In December 1862 two more samples are received from Dr. Brandis in referring to which he writes.

"I have the honour to submit two samples of Cotton of this years growth, from the Government Cotton Garden, Nyonugneehin, near Myodwin.

(1) New Orleans Seed, third season sown 19th June gathered 9th Oct.

(2) Ditto, Ditto, Ditto, with seed, ditto: on which the Cotton Committee report, as follows:—

"The Cotton from New Orleans seed grown at the Government Cotton Garden at Nyonugneehin, near Myodwin in Burmah, under the superintendence of Dr. Brandis is exceedingly good in color and condition; it is of fair strength of fibre, and, when compared with the Cotton Supply Association's photographed New Orleans, it is quite equal in length of staple.

It is on the whole one of the nicest and most useful kinds of Cotton I have seen produced in India; it is fully equal in value to fair middling Orleans.

(Sd.) W. HAWORTH.

"I have nothing to add to Mr. Haworth's Reports on the above samples of Cotton, in which I entirely concur."

(Sd.) ST. DOUGLAS.

The sample grown from New Orleans represents a very useful description of Cotton. It is somewhat uneven in staple, but the fibre is of fair strength, whilst the color is decidedly superior to musters of American-grown middling Orleans, distributed by the Cotton Supply Association. I concur in Mr. Haworth's opinion regarding its value in the Home Market.

(Sd.) T. H. MOSLEY.

"The samples from Dr. Brandis are rather short in staple for New Orleans, but the color and fibre is good, and such quality would meet a ready market at this time in Liverpool.

(Sd.) W. S. FITZWILLIAM.

PORT BLAIR.

Memorandum by Major J. C. Haughton on his experiment at Port Blair with New Orleans cotton.

In a letter enclosing this Memorandum, Major Haughton states that he had intended to send the result of other and separate sowings managed by the convicts, but they have so confused the products that he has no confidence in their returns. Besides which, he believes the greater portion of the cotton has been stolen, as it is required for a great variety of purposes by the convicts, and not being procurable in the market was sure to be pilfered :—

“Last year I gave an account of the results of an experiment with New Orleans cotton seed furnished by the Manchester Association. That account requires slight revision. I now propose to recapitulate and correct the report given, carrying on results to the present time.”

“The cotton seed was sown in June 1860 broad-cast, by a Chinese gardener, who finding that it did not germinate as rapidly as he anticipated, collected the seeds and dibbled them irregularly into the ground. The produce of the small plot under report was.

Clean Cotton....	...	...	£ 7 0
Cotton Seed. ...	...	...	„ 20 0

“The measurement of the ground was made by a native who had been employed on the Revenue Survey, and was supposed to be sufficiently correct. It has since, however, been found to be very incorrect. An exact survey proves that the space covered by the cotton was 4,822 square feet, or decimal fraction .01107 of an acre. The true rate per acre therefore was

Clean Cotton	...	...	£ 63 2 oz.
Cotton Seed	...	...	„ 181 0 „

Total ... £ 244 2 oz.

No attention whatever was paid to this crop beyond perhaps the first month of its growth. It was not manured or watered at any time. The crop was completely gathered by the middle of April 1861. The plants were left growing, having attained a height of two or three feet. Early in August pods were again bursting, and at the same time some from the seed sown elsewhere in May was flowering. By the end of November about 50 lbs. of uncleaned cotton had been collected, and it has continued to be gathered ever since. The amount now coming in is small, and a whole year has

110 *Further Report on the sowing of Exotic Cotton Seed*

elapsed; I therefore propose to consider that, gathered up to the present date, as the crop of the year, it is

Clean Cotton	..	..	..	£ 64
Cotton Seed	..	..	..	„ 205
Total				£ 269

Or per acre

Clean Cotton	..	..	£ 578
Cotton Seed	..	..	„ 1820

“In considering the profits of this crop, allowance must be made for the short comings of the first year. After this is made it will be seen that the out-turn is respectable.

	Clean Cotton per Acre.				Cotton Seed.	
1st year	..	£ 63	„	..	..	£ 181
2nd „	..	„ 578	„	..	..	„ 1,820
Total	..	£ 2,641	..	..	..	22,001

320½

1000½

“Three hundred and twenty and half pounds of clean cotton and one thousand and a half of cotton seed per acre.”

“I think this result though based on the average of two years only may be looked for continuously. It is clear that the plants had not the first year acquired sufficient growth. I intend to allow those growing to continue a third year, in which if only half the crop of this year is produced, the entire result will be satisfactory, provided that the cotton has not much deteriorated, a point I must leave to the decision of your Committee, for whose opinion specimens have already been forwarded. It appears to have been a mistake to wait to so late a period to sow the cotton as June. I find the plant bears a good deal of sun. This year we had a very smart set in of rain for three or four days towards the latter end of March, and I took advantage of it to sow some of the seed of this year's cotton. All germinated freely, and it is now looking very healthy. I have sown it closely in beds, intending to transplant when the rains set in. One thing is quite clear from this experiment, *viz.* that the second and

following years are those which must be looked to for profit. Now, having recorded these facts, I leave the readers of this Memorandum to form their own conclusion."

CHITTAGONG.

Letter from J. D. Ward, Esq., Collector of Chittagong, in reference to some samples of cotton submitted to the Society's Meeting of July 1862.

"In continuation of my letter No. 688, dated 21st February last, I have the pleasure to send you some of the cotton which Mr. Sarson has succeeded in producing from the New Orleans seed which I received from you.

"This seed was sown in November last, and immediately after we had some six or eight days of very heavy rain; several of the young plants died, and up to April last none had attained a greater height than 18 inches. In the course of April and a part of May, we had a few showers which brought them up well, and the bolls came to maturity in the early part of May. Each tree bore about 16 bolls on an average. The trees flowered in March, and were planted in ridges about a foot apart from each other.

"To enable you to compare this produce with the common Chittagong cotton, I send you a few pods of the latter. The staple and quality of the New Orleans is evidently very far superior to that of the Chittagong, but I should like to hear your opinion of its value compared with the value of the best New Orleans cotton sold in the market.

"I have very little doubt that in point of season your seeds had not a fair chance. As I before told you, Mr. Sarson's trees are the only ones which have borne, and their position was peculiarly favorable—they were immediately under his windows and under his own immediate supervision. Mr. Sarson has the advantage of a better horticultural experience than most of us possess, and he planted them in a well sheltered place.

"The common country cotton is sown in April and May, and this year I have sown all the Orleans seed which I had over from my last experiment and all the Egyptian seed which you sent me, in March. The former has entirely failed and was evidently da-

amaged by damp, but the latter is springing up splendidly, and I hope to give you a very full and satisfactory account of it. I have some immediately outside my verandah and carefully fenced, and I have given some to all the gentlemen about the station and to the native hill-cotton growers. Captain Graham, the Hill-Superintendent, has promised to watch the latter carefully, and the results of their sowings will show whether the very crude method of cultivation here pursued is capable of producing good foreign kinds of cotton. If the result is favorable, I might try some of the seed from the new plants next year, and I might then form some estimate of the liability of the cotton to deteriorate in quality."

The exotic cotton submitted by Mr. Ward is, apparently, from Egyptian, not New Orleans seed; it partakes a good deal of the character of Egyptian, but it is much stained, probably from the bolls having been kept too long on the bushes. The indigenous cotton is of good colour, but of very short staple, and very adherent of the seed.

*Cotton Cultivation Experiments in the Straits Settlements.
Communicated by the Government.*

From the RESIDENT COUNCILLOR P. W. ISLAND.

To the DEPUTY SECRETARY TO GOVT. STRAITS SETTLEMENT.

Dated 15th, April, 1863.

SIR,—I have the honor to acknowledge the receipt of your letter No. 131 of the 21st Ultimo, and to forward a report from Mr. Vermont, who is in charge of the Batu Kawan Estate; also Extract of reports from Brokers at home on the produce. It will be seen that the price put upon the cotton in the English market was most tempting, yet from one cause or another the cultivation does not appear likely to answer,—one of the Chief difficulties being the uncertain nature of our climate; for though we are pretty certain in Penang to get nearly a month's dry weather at the beginning of the year yet heavy rains do at times prevail alike in January, February or March, while in other months they may be ordinarily looked for. Under these circumstances I am very doubtful that Penang will ever become a cotton producing country, though Mr. Brown the enterprising proprietor of the Batu Kawan Estate is still willing to continue his experiments, and is of opinion that a return may be hoped for equal to that from Suvar.

The Cotton supplied to the Police has flourished fairly considering the confined space available, but I was in great hopes of a good result from the House of Correction garden, as the Overseer takes much pains with it. The return however has been very trifling very few comparatively of the seeds germinating—the soil, a sandy loam, was well adapted to the purpose, but the failure has probably been caused by insufficient drainage.

I have &c.

(Sd.) H. MAN,

Resident Councillor.

L. NAIRNE Esq.

*Battu Kawan Estate Province Wellesley :
3rd April, 1863.*

DEAR SIR,—I have the honor to acknowledge the receipt of your letter of the 30th March enclosing one from the Secretary Agricultural and Horticultural Society, Calcutta, with other enclosures requesting a report on the success or otherwise of the small parcel of cotton seed supplied me some time ago.

I regret that no separate account was kept of this particular batch of seed, the return being made up only with reference to the quantity of cotton picked from each individual field which will be seen by referring to the experiment No: 6.

As all my experiments may be interesting, and of some use to those interested in cotton cultivation, with your permission I will take the liberty to recount them in detail.

No. 1.—During the month of August 1861, His Honor the Governor kindly sent a batch of cotton seed to be distributed to the different Proprietors and Planters; I was fortunate in securing a small quantity, and, although at the commencement of the wet season, I sowed it on the old cane banks, on rather a low and poor soil, newly cropped with Sugar Cane, the idea being to endeavour to grow cotton as a fallow after cane: the usual distance of cane banks being six feet apart, the seeds were therefore sown in holes on the banks 6 x 4 three seeds in each hole, covering an area of about half an acre; it soon germinated, and after thinning, no further notice was taken of it, with the exception of weeding; the plants grew wonderfully and promised a large return, but soon after the bolls formed, the plant withered and the bolls opened damaged: this small piece, widely planted, gave a return of 63 lbs clean cotton; a sample was sent to England and it was there valued at 25d. per lb.

No. 2. Thinking that perhaps the wet weather might have

been the cause of failure, the proprietors requested me to try further experiments. I therefore planted two fields in December, 1861, "the end of the wet season," in extent 35 acres, with imported Egyptian seed from Bombay, with the same object of fallow: this time however instead of 6×4 as before, it was planted 6×2 , the land poor, and in some parts low; this also proved a failure; whether from bad seed or dry weather, or poor soil, a great portion of the seed did not germinate: about 5 acres of the latter part of the field however looked healthy, it was picked in May, during damp weather, and gave a return of 1,163 lbs: this and the former 63 lbs were pressed into 4 bales and shipped to England, 2 bales to London and 2 to Liverpool, and realized upwards of £100, with a very favorable report both with respect to appearance and staple. At the time of shipment we could not anticipate this result, and were therefore nothing daunted by the small returns.

No. 3. In May 1862 planted out 23 acres carefully preparing the land according to the American ridge system, sowing 4×1 and applying a small dose of Guano: half of one of those fields died off after sprouting and only 158 lbs of clean cotton was the result. No. 2 experiment gave a second chop of 169 lbs: this failure I attributed in a great measure to the land being peaty and heavy rain.—From these experiments, and long experience, I came to the conclusion that October, although the wettest month in the year, was the best for planting cotton, for the reason, that our brief dry weather is usually from the month of January to the end of March; sowing therefore in October gave the bloom and cotton bolls every opportunity of coming to perfection about the time of the dry weather.

No. 4. I therefore prepared a piece of land 3 acres in extent, 2 years reclaimed from the Mangrove and never planted; on the 1st October 1862 sowed it 4×1 with imported seed; this did not germinate, owing to an un-

usual dry period. On the 14th replanted with acclimatized Egyptian seed, the plants grew well and healthy and were seen by several who acknowledged it was equal to any they had seen in America ; but it only gave a return of 248 lbs.

. No. 5. 14th October 1862, was also sown a field 22 Acres in extent with our own seed, the land carefully prepared and manured : this came to bloom during heavy rain and 3 weeks earlier than the last experiment although planted out at the same time : the result was the plant became surcharged with sap, which the cotton seems to absorb, and in place of coming to proper maturity rots in the shield ; the return was only 74 lbs.

No. 6. On the 3rd December 1862 received the seed alluded to in your letter ; sowed in a corner of a field about $\frac{1}{4}$ of an acre, and the remaining part of the field, 24 acres, with our own seed ; land good, well cultivated, under cane cultivation 5 years ; return 723 lbs from the whole.

As a final experiment I am now preparing a field 30 acres in extent, rich and new land and well cultivated ; and if the results from it are not more favorable than the above, I must abandon the cultivation on this Estate: at the same time not from my thinking the cultivation hopeless or unprofitable, but owing, from our system of boating our produce, we are unable to drain sufficiently deep for cotton planting. The expenses of cultivation are very trifling, \$ 15 the acre covering all ; the picking is the most expensive, but this is partly from want of experience in the hands.

I have much pleasure in forwarding a sample of the Cotton ; any further information in my power if required will be gladly given.

I remain, Dear Sir,
Yours faithfully,
(Sd.) J. M. VERMONT.

Report on 2 Bales Cotton per "ROBERT MORRISON," on account of Messrs. BROWN & Co.

The 2 Bales of Cotton, of which I have seen the samples, By C. Thomson, B. K. have suffered from wet, and there are C. 1 spots, yellow in color with the staple partially rotten. But generally speaking the staple is long, fine, and strong, of the Character of Egyptian Cotton. It is rather mixed and irregular in quality, but may be valued 24 @ 26d. per lb.

We have examined the 2 Bales of Penang Cotton and By James Bateson report them as generally brown, mixed & Co. with a little decayed from stain, clean, and although irregular, good and fine in staple. Value about 2s. per lb.

LONDON :

10th December, 1862.

We hope to furnish report on the other 2 Bales of next Mail which will represent their value in London. The above report was made by Liverpool Brokers.

Report on Cotton of "ROBERT MORRISON" on account of Messrs. BROWN & Co.

2 Bales Cotton rather mixed in color (a part yellow) good By Brown Buckley strong silky fibre and tolerably long & Co. B K. C 1 and free from seed ; value 26d. per lb.

The above is very superior Cotton, preferable to any samples received from the East Indies, and if sent forward in parcels of two or three hundred Bales would sell freely at relatively high rates. The color however is not white enough, the end of the different flakes having a yellow tinge.

LONDON :

29th December, 1862.

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Account Sales of 4 Bales Cotton per "R. MORRISON," an account of Messrs. BROWN & Co.

B K C	2 Bales Cotton wg 587 lbs. @ 26d. $\frac{1}{2}$ lb., ...	63 11 10
	2 " " " 590 " " 26d. " ...	63 18 4
	<u>4 Bales.</u> <u>1,177 lbs</u>	<u>128 0 2</u>
Charges.		
		£. s. d.
Carriage 2 Bales to Liverpool, ...	1 10 10	
Dock Company charges, ...	0 12 8	
Freight on 102 ft. 8 @ 110 $\frac{1}{2}$ 50 ft., ...	11 6 0	
" 2 Mos. Int. on " " ...	0 2 0	
Insuring £65 @ 60s. $\frac{1}{2}$ cent. £1 19 0		
" Stamp 4-3 Offg. 6/6, 0 10 9		
	<u>2 9 9</u>	
Fire Insurance on £200 @ 5 $\frac{1}{2}$ cent. 0 10 0		
Brokerage on, £127-9-4 @ $\frac{1}{2}$ " " ... 0 12 8		
Commission on " " 2 $\frac{1}{2}$ " " ... 3 3 8		
		<u>20 7 7</u>
Cr. 4th April 1863, ...	£.	107 12 7
Invoice, ... 1,201 lbs.		
Sales, ... 1,177 "		
	<u>24 = 2 $\frac{1}{2}$ cent.</u>	

LONDON :
26th January, 1863.

E. E.

From the OFFG. RESIDENT COUNCILLOR,

Malacca.

To the DEPUTY SECY. TO GOVT. STRAITS SETTLEMENT,

Singapore.

Dated Malacca, 24th April, 1863.

SIR,—In answer to your letter No. 131 dated 21st March 1863, I have the honor to state that the seeds sent here with your official Memo : No : 320 dated 2nd October 1862 have all been distributed throughout Malacca to different Gentlemen and Chinese who hold pieces of cultivation ;—to the different Police and Convict Stations.—Wherever the plants have been attended to they have generally succeeded more or less,

according to the richness of the soil ; most of the seed died from want of attention, it having merely been strewed on the ground and left to nature without watering or covering the young plants in dry weather, which caused a report that cotton would not succeed here : I append to this a statement of Mr. Rodyk, who was interested in the cultivation of the plant, with a specimen of the cotton grown by him ; also some from the Convict lines, and a third sample grown at Keseang and other stations, which has not been so well attended to nor grown in such rich soil, the latter place being more sandy, the other being more of a mould : seeds that have been cared for have all germinated and the plants thriving well, but they are infested with insects ; a good deal the most successful method has been to raise seedlings in a nursery and then plant them out, attending to the watering of them in dry weather. I consider it to be advisable to give the growth of cotton a fair trial in Malacca if I could get a sufficient quantity of seed, and with His Honor's permission, I would select a piece of ground and have several convicts told off for the particular care of the cotton garden ; and I am sure that if it succeeds many of the Chinese and others here would invest capital when they once saw the method of planting and rearing it.

I have &c.

(Sd.) F. L. PLAYFAIR,

Offg. Resident Councillor.

To the Honorable Captain F. L. PLAYFAIR,

Offg. Resident Councillor Malacca.

SIR,—In compliance with your request, I have the pleasure to append at foot hereof a short account of the growth and culture of the Egyptian Cotton, as raised by me on a small tract of land, from some seeds which I obtained from the Resident Councillor of this place about two and a half years ago. The result of the experiment has turned out more favorable

than I had reason to believe it would have, as some ten years back I was induced to try a similar experiment of the Periambooco Cotton, on a somewhat larger scale, extending over an area of six acres of high land situate in the same locality ; but I was not so fortunate on that occasion, as with the exception of only a few, all the plants died prematurely, although the greatest care and attention had been bestowed upon them ; the seeds, from which they germinated, were moreover quite fresh, having been gathered with mine own hands from a large tree which was then growing most luxuriously at the back part of the premises of the present Girl's Free School in Tranguerrah. The only cause I could ascribe to the failure was an overmoisture and saturation of the roots, produced by incessant heavy falls of rain just about the time that the plants began to flower and look most promising.—Notwithstanding this great drawback, I am still inclined to view the cultivation of cotton in Malacca with the same favorable light as I once did ; but to make the speculation remunerative to the Planter, the enterprise must be conducted on a scale of magnitude ; a risk which I suppose no one here will ever undertake, unless the *Government* will first, set the example, which I also suppose is quite as unlikely.

Accompanying is a specimen of the cotton grown by me, which I beg you will submit to the Honorable the Governor with a Copy of this letter and Memo.

I am &c.

(Sd.) W. ROBYK.

MEMO.

In the year 1861 I obtained from Captain Burn, Resident Councillor of Malacca, a small supply of Egyptian cotton seeds, which I understood from him, had been sent to the Straits Settlement by the Government of India, for the purpose of being widely distributed and propagated. These seeds were afterwards sown by me in soil prepared with cow dung and burnt

earth ; care was taken to irrigate them morning and evening, till they germinated, which some of them did in the course of a week or ten days. When the Plants had attained the height of between four and five inches, they were carefully removed and planted out in soil similarly prepared, the irrigation being continued every morning for about a week, as the weather was hot and dry. From that period they were left to chance, as no further care was taken of them till about the third month, when they began to flower, each branch yielding from fifteen to twenty pods. Care was then taken to destroy the small insects and red bugs with which the pods were infested. About the fourth month the pods began to open, a few at a time daily. Those that did so during the dry weather produced very white cotton and of fine quality.—Some of the trees grew to the height of five and six feet and bushy from top to bottom. About the eighteenth month symptoms of decay began to shew in the branches, when the trees gradually withered and were thrown away. I kept no account of the quantity of cotton yielded from each tree, but it will suffice to say that the crops more than realized my expectation, and that if the cultivation of this species of cotton were better known and appreciated in Malacca than it is at present, it would prove more remunerative to the Planter than the cultivation of Tapioca, for which there has been a perfect mania within the last three or four years.

MALACCA : (Sd.) W. RODYK.
30th March, 1863.

(True copy.)

(Sd.) F. L. PLAYFAIR,
Offg. Resident Councillor.

From the SUPERINTENDENT OF CONVICTS AT SINGAPORE.
To the SECRETARY TO GOVERNMENT STRAITS SETTLEMENT.
Dated Singapore, 13th April, 1863.

SIR,—In reply to your letter No : 191 of the 21st Ultimo

forwarding for my perusal, letter to the Honble the Governor Straits Settlements from the Secretary to the Agricultural and Horticultural Society of Calcutta, in reference to the success or otherwise that has attended the planting of the cotton seeds received from the Society; I have the honor to report briefly, as requested, that they were planted in the months of November and December of last year, in the two descriptions of soil which form, in the main, the surface soils of Singapore capable at all of any cultivation, *viz.* the yellow loam, and black alluvial soils of the plains and valleys. The localities selected for experiment in the various kinds of loam soils were at Kranjee, Sillatar, Serangoon, and at the Government Brick Fields, and in the black soil at the Balestier Estate. The Ground was dug to the depth of a spade, and in the two latter cases was slightly manured.

The result of the planting has been as follows :

At three places in the interior of the Island, looked after by Assistant Supervisor Magalhães, the plants came rapidly to the surface, but on beginning to shew pods, they were attacked at once by insects, and though the plants themselves have many of them grown to 3 feet in height, and are healthy looking, few, if any of the pods came to perfection.

At the Government Brick Field where a small plantation, to the extent of 600 square yards, was made, and the soil slightly manured, the plants average now in height from 3 to 6 feet, and are all healthy. The pods are here and there pierced by the insects, but not to any appreciable extent. Overseer Ross has had the oversight of this plantation, and watched the plants constantly. The specimen marked 1 is cotton obtained from these plants.

At the Balestier Estate many of the plants, after attaining half their growth, were injured by the rising of the Tide to an unprecedented height, but they are now again healthy looking, but are none of them of the height or condition of those at the Government Brick Field. Seeds are being planted on

higher ground. Specimen No. 2 is cotton collected from these plants which were under the charge of Overseer Charley.

The maximum of heat and cold during December was 92-71½, and 16 inches of rain fell during the month.

I am informed by Supervisor Magalhães, who, before he entered the Government service in 1850, had charge of a cotton plantation, that it was found that so soon as the pod appeared, it was attacked by insects; and so greatly did the insect afterwards multiply, that it was found impossible to preserve the plants from its ravages, and the cultivation was given up in consequence. This occurred also I am told in an Estate belonging to G. H. Brown Esq., the cotton in those pods which was even allowed to come to perfection, it is stated, was destroyed by the rain.

Notwithstanding this I am still somewhat sanguine in the matter, and if His Honor will permit me to employ 10 Convicts, and some trifling expense for tools, baskets, &c. I should like to test the cultivation still further on a larger scale, for I am inclined to believe that the success of the Brick Field Plantation is partly due to there being no low brushwood in its immediate vicinity to harbour insects. The cotton, as far as I am able to judge, is of good staple, but of course unless it can be grown satisfactorily on a large scale, no capitalists will undertake the planting, and it is certainly desirable to ascertain this fact beyond a doubt.

I have &c.

(Sd.) J. F. A. McNAIR, *Captain.*
Superintendent of Convicts.

Notes on the Silk Worm of the Shantung Province N. China and on a species of Polygonum affording a blue dye. By Assist. Surgeon MAINGAY, M. D. Bengal Establishment.

In the course of a Botanical excursion into the Shantung Promontory, North China, in September 1862, I was struck by the number of oak plantations planted on the slopes of the hills, and was somewhat puzzled as to the uses to which they could be applied, when I at length discovered they were intended as food for the worm producing the well-known Shantung silk. I obtained caterpillars and chrysalides for the purpose of identifying the species. These with two exceptions perished on my journey from North China to India, but from the two remaining I am enabled to offer a detailed description of the Insect. In so doing I will add a few preliminary remarks on the physical characters of the district.

This consists mainly of irregularly disposed ranges of granitic hills of elevations varying from one to three thousand feet, and, for so small a height, rugged in the extreme. In addition to the oaks, their slopes are also studded with plantations of the Chinese Fir (*Pinus Sinenensis* Lamb.) which add greatly to their picturesque beauty. The rivers drain on the North into the Gulf of Pechili, on the South into the Yellow Sea; these large Gulfs being separated from each other by the Shantung Promontory. This latter extends seawards from the Main land for about fifty miles with an average width of thirty, and terminates abruptly in a rugged Headland. The river beds are broad and sandy, resembling in this respect those of Indian rivers, but the streams themselves are insignificant. Little rain seems to fall, and scarcely any snow, though the winter frosts are most intense. The atmosphere at the period of my visit was marvellously clear and bracing; the Bay of Chefoo or Yantai being, on this account, a favourite sanitarium for the British and French Men of War. The climate in its essential characters seems to approximate closely to that

of the Northern slopes the of Himalaya. The inhabitants are a well-fed and contented race; they are more robust than their Southern brethren and of a fairer complexion. The country is admirably cultivated and produces Leguminous and other crops in great abundance. Confining myself for the present to these remarks, I shall now pass to a description of the Insect more immediately the subject of my present communication.

The perfect insect closely resembles the *Antherosa Mylitta* of Drury, figured in Jardine's *Natural Library* vol. vii. tab. 14 but differs in so many points as to authorize me in describing it as a well-marked variety of that species. The first anterior segment of the caterpillar forms a small rim projecting slightly over the head. The 6th, 7th, 8th, and 9th segments support the false legs, and the anal segment is longitudinally bifid. The colour is a bright grass green, resembling in this respect the Larvæ of the well-known *Saturnia Pavonia Minor*, or Emperor moth of our English uplands, and the body is marked laterally and dorsally on each side, with a row of gold coloured spots. These are, in my specimen preserved in spirit, four in number laterally, two dorsally; and are borne respectively on the 4th, 5th, 6th, and 7th segments. They surmount small tubercles which extend to the anal segment. The body is covered with scattered hairs, and it attains its full growth, with a length of two inches, in August and September. In the perfect insect the antennæ are, in both sexes, pectinate; the teeth arranged in pairs and elegantly ciliated with fine hairs. In the Male the pairs of teeth are shortly united at the base. The main features of colouring of the wings and body are the same as in *Anth. Mylitta*, but with the following points of difference:—

The ocelli on the Anterior wings are not divided by a black line, and are surrounded by a fuscous border about $\frac{1}{2}$ a line broad, which is again margined anteriorly by a white and a rose coloured crescent, both becoming continuous posteriorly with a

yellow border and a faint black crescentic line. The ocelli on the Posterior wings are similar to those on the anterior, with the exception of the rose coloured crescent being more defined.

The anterior margin of the anterior wings is bordered by a greyish brown line which extends continuously across the Thorax. The Basal angle has a rose coloured and white transverse line situated $\frac{1}{4}$ of an inch from the articulation. A second similar line is also placed further outwards, and a third commences near the apical angle of the anterior wings, and extends continuously to the exterior edge of the posterior wings, terminating about two lines from their posterior angle. The underside of the wings is paler than the upper, and the continuous line on the posterior edge of the latter is represented by an interrupted series of dark rose coloured spots with their paler convexities directed outwards. The anterior wings are strongly falcate and their extreme breadth is $4\frac{1}{2}$ inches. The Cocoons are very slightly pedunculated and by no means resemble those of *A. Mylitta*. They are generally surrounded by leaves. I imagine the Chinese breed the young worms in confinement and then place them on the plantations, which are not used indiscriminately but allowed regular periods of rest, or they may adopt the plan of placing the pregnant females on the trees selected as the future food of their progeny. I am, I regret to say, not in a position to state in what manner this species differs from the Jarroo worm of Assam, as I have no access at present to any published description of that species. The present form however, judging from specimens shown to me as the Larvæ, is very different from the silk producing moth of the silk districts of Central China, from which the main supplies of commerce are derived. These are situated on the Grand Canal near the once flourishing and, in Chinese annals very celebrated, city of Soochow, which has within the last few years been reduced to a heap of ruins by the Chinese rebels. The movements of these latter render it necessary to note carefully all silk producing districts,

as they have threatened, in revenge for foreign interference, to cut down the Mulberry trees in the Soochow silk districts. This threat they will scarcely carry into execution, as they obtain large transit dues on the silk which passes through their posts, but they may render the country so unsafe, as they have already done in other parts of China, that the cultivators will prefer abandoning their homes to suffering Taiping tyranny. It is no doubt true, as stated triumphantly by some Taiping sympathizers in the House of Commons, that since the rebels held the Silk districts an increase in the exportation has taken place; but the reason of this has not been an increased production; but an inability of the Chinese themselves to purchase silk in the quantities they formerly did for their own domestic use, owing to the unsettled state of their country and the consequent stagnation of trade. It will be seen that under rebel rule this apparent increase will soon be converted into a steady decrease in the supply. Even now the Merchants of Shanghai have to pay enormous wages proportionate to the risk, to induce Europeans of the lower class to proceed up the various creeks to purchase the article, the primary result of which will be an enhanced price. The Shantung silk district too is in danger, as it has already been invaded by bands of rebels said to come from the province of Shensi.

Under these circumstances I have now to invite attention to the ease with which the Shantung silk worm may be introduced into India, as being more hardy than the Indian varieties. It has moreover the advantage of feeding on the various species of oak, all hardy in their growth, otherwise they would perish in the rigorous winter climate of North China, and in other respects admirably adapted for growth on the dry slopes of the Northern Himalaya or in the Kangra and other North Western Vallies, in which already cognate species are indigenous.

Easy of introduction, the next and most important enquiry

in relation to this subject is connected with the profit likely to accrue.

To facilitate an answer to this I have carefully weighed the cocoons in my possession with the following results. A well-formed cocoon, with all extraneous matter, as leaves and the dead or empty chrysalis, removed, weighed exactly one scruple, apothecaries weight. The weight of six average sized empty cocoons was four scruples, nine grains, giving an average to each of 15 grains nearly. A piece of the woven silk half a yard square weighed 273 grains; consequently, allowing in each cocoon $\frac{1}{3}$ rd as loss from the glutinous matter with which it is cemented, we have twenty seven required to make the above mentioned piece of silk. I enclose a sample of the manufacture for the inspection of the Society.

In concluding this paper I may take the present opportunity of drawing attention to another product of the Shantung district which may prove of ultimate importance. I allude to a species of *Polygonum* cultivated by the cottagers for the sake of a blue dye afforded by it. This colouring principle is so strong that my Herbarium specimens, in drying, became very strongly tinged by it. In a description of one of our early embassies to Pokin, I think McCartnoy's, a species of *Polygonum* was mentioned as being cultivated near Peking for the sake of a dye afforded by it. I have little doubt but that the Shantung plant is the one alluded to.

It also would thrive well in the upper provinces of India, and even in the summer climate of England. Its seeds can easily be procured from H. B. M. Consul at Yentai; They were unfortunately unripe when I collected my specimens.

Note on the Agur, Eagle, or Agallochum tree (the Clign Aloe of Scripture?)

There are in Cachar two distinct species of tree, bearing however a great resemblance to one another in externals

and scarcely distinguishable except by the fruit: both possess a thin tenacious fibrous bark excessively light and spongy wood, and a straight uniformly tapering columnar stem without any buttresses, and branching high above the ground—the fruit of the two trees is however widely different:—one bears a large round yellow fruit, with a thin skin, and having a mealy, somewhat glutinous, edible pulp, surrounding 5 kidney shaped sharp edged seeds.—These seeds have a hard shell and are about the size of an almond.—In germinating the seed is borne up and splits along the edge, disclosing two large seed leaves, which as they unfold cast off the shell. This tree is called by the natives “Petakhowra” and does not produce “aloes wood.” Of the other species, which is the true Aloses tree, the seeds have a black thin shell, are about the size of a pea, pointed on one side and having a small tail attached externally to the opposite side:—in germinating the seed is, as in the species just named, also raised into the air:—the seed case is leathery, corrugated externally, and watch shaped, opening by two valves, each of which contains the halves of two compartments roughly triangular and answering to the shape of the seed, of which there are two to each pod:—the tree flowers in March, April, and casts its seed in June, July; shortly after the seed cases themselves fall.

It is in the males only, or as the natives call them “Moo-nees” that the resinous substances called Agur or Aloses wood is to be found, and it is in vain to look for it in the fruit bearing or female tree of the same species,—as well as in the “Petakhowra”.

Were the wood less soft than it is the labour of procuring the substance would probably exceed its worth, since the percentage of trees which contain it is very small and does not probably exceed one; and each tree has to be cut down before it can be discovered whether the resin exists, there being no external diagnosis. If the resin should exist, the vein will most likely be found cropping up at a point eight or ten feet

below the lower boughs on the outer side of the bend, if there be any ;—from here it is followed down as far as it exists, or as is thought worth while.

Occasionally, but very rarely, a tree is met with that contains as much as 300 Rs. worth ; sometimes the entire substance of the tree, from almost immediately under the back, becomes converted into Agur for a considerable way up, so that a single blow of the axe lays it open ; but one season with another the profits of the kumlaha are by no means inordinate.

The “Tuggur” tree is possessed of great vitality and a wonderful power of renewing its bark, even when the latter has been scorched off all round by fire for 15 feet and more above the ground :—the wood is disposed in concentric layers which easily separate, and should, owing to any cause, the upper layer be splintered or detached, the bark leaves it outside and forms itself on the second layer although the wood per se is very perishable and rots completely in one year, the parts that are at all impregnated with the peculiar resinous substance are protected from decay and last as long as the most durable timbers ; hence any Agur there may be in a tree is easily disengaged a year after the cutting over of the tree.

It is a difficult matter to decide what is the predisposing cause of the secretion of this peculiar oleo-resin : it is not old age, as it is found as often in young trees as in old, and though it gains in concentration and quantity by age, the nucleus is generally formed in the youth of the tree.

It is no sign of decay or unhealthiness, as the tree containing it thrives apparently as well as the others, and if the parts affected be examined it will be found that there is no hollowness or unsoundness, but that the woody fibre is perfectly sound, and merely impregnated or soaked to a greater or less extent with the resin, forming, when of a light brown colour, the “doom” and when of a black or blackish brown, the “Agur” of commerce ; the former fetching from 1 to 3, the latter 7

to 10 Rs. per seer. In no other part of the tree is the peculiar fragrance of the resin to be found except in the seed cases, in which however it is very feeble. The kernel of the seed is rich in an oil, which is however destitute of aroma.

Spirits of wine separates the resin from the woody fibre and takes up both it and the oil freely, forming a deep red solution: on admixture with water the oleo-resin is suspended, and renders the water milky: the oil comes over on the application of a gentle heat. By the native method the wood is bruised in a mortar and then subjected directly to distillation in water;—the otto which comes over is more highly prized than that of roses.

The trade in Agur is probable of very old standing; the Agur kumlahs are now obliged to go considerable distances to find trees in sufficient number to make their trade pay: they now frequently start in bands, by boats, up to the valleys, with as much as three months provisions with them, and well equipped for a long stay in the jungles:—the most experienced Agur-kumlahs are from Pertabghur, or the valley of the Lunglahs.

One at least of the petty Rajahs of Assam used to send his tribute to the viceroy, during the Mahomedan rule, in this substance, and it is used by the Armenians as incense in their Churches: it is by no means improbable it may thus have found its way into Syria and Palestine and entered into the fragrant oils and unguents to which the eastern nations, and among them the Jews, are so partial.

C. BROWNLOW.

Monthly Proceedings of the Society.

Thursday, the 22nd October 1862.

A Grote, Esq., President, in the chair.

The proceedings of the last meeting were read and confirmed, and the following gentlemen were elected members :—

D. G. Morgan, Esq., W. F. Graham, Esq., George Buchanan, Esq., Lieut. G. Forsyth, Charles Brownlow, Esq., W. Gordon Young, Esq., Major A. H. E. Hutchinson, Surgeon Major R. Whithall, and Lieut. J. Burnell.

The names of the following gentlemen were submitted as candidates for election :—

J. Robert Savi, Esq., Indigo Planter, Nohatta, Jessore,—proposed by the Acting Secretary, seconded by Mr. A. Grote.

Major Hugh J. Pester, 9th Regiment N. I.,—proposed by Mr. W. Anderson, seconded by the Acting Secretary.

George Ross, Esq., Merchant, Calcutta,—proposed by the Acting Secretary, seconded by Baboo Peary Chand Mitter.

Captain W. Kales, Commanding H. M. S. *Nemesis*, Moulmein,—proposed by Mr. W. Eames, seconded by the Acting Secretary.

Major Snow, Commissioner of Jubbulpore,—proposed by Mr. W. R. Gilbert Hickey, seconded by Mr. R. H. Russell.

W. J. Burnell, Esq., Indigo Planter, Bowgong, Purneah,—proposed by Lieut. J. Burnell, seconded by the Acting Secretary.

Captain H. D. R. Smith, Executive Engineer, 2nd Division Oudh Roads,—proposed by Lieut. Malcolm G. Clark, seconded by Mr. A. Grote.

J. R. Willoughby Osborne, Esq., Agent to the Governor General, Rewah,—proposed by the Acting Secretary, seconded by Mr. A. Grote.

R. F. Stack, Esq., Solicitor, Calcutta,—proposed by Mr. J. Scott Elliott, seconded by Mr. A. Watkins.

Dr. C. J. Kirwan, Civil Surgeon, Seetapore Oudh,—proposed by Mr. A. Grote, seconded by Mr. R. H. Russell.

Dr. R. Fryer, Assistant Surgeon, Bancoorah,—proposed by Dr. J. M. G. Cheeke, seconded by Mr. A. Grote.

Captain T. H. Tronson, Superintendent for Peninsular and Oriental Company, Garden Reach,—proposed by Mr. A. Grote, seconded by Mr. R. H. Russell.

Captain M. J. White, District Superintendent of Police, Bijnore, Behar,—proposed by the Acting Secretary, seconded by Mr. A. Grote.

Proceedings of the Society.

The following contributions were announced :—

1.—Journal of the Asiatic Society of Bengal, No. III, of 1863. Presented by the Society.

2.—The following Reports, presented by the Government of India :—on the Administration of the Bengal Presidency ; of Port Blair ; of the Hyderabad Assigned Districts, and of the Straits Settlements, for 1861-62 ; Memoirs of the Geological Survey of India, Part III., Series II. ; Report of the Geological Survey for 1861-62 ; Transactions of the Government of India in the Military Department ; and Report on the External Commerce of Bengal for 1861-62.

3.—A light Plough. Presented by Messrs. Moseley and Hurst, Honorary Agents, Manchester Cotton Supply Association.

4.—An improved, or “ Nil desperandum,” Plough. Presented by J. Stalwart, Esq., and accompanied by extract of a letter from Mr. C. W. Gale, Indigo Planter, Tirhoot, on the advantages of, and mode of working, the plough. This, and the plough presented by Messrs. Moseley and Hurst, were referred to the Committee of Implements of Husbandry and Machinery for report.

5.—A few garden seeds from Alexandria Presented by Captain Paterson, of mail steamer “ *binla*.”

6.—Sample of Cotton grown from native seed by Mr. Mercer, at Futtighur, presented by Messrs. Moseley and Hurst. This is a superior native cotton, and was referred to the Cotton Committee.

7.—Two bundles of Orchids. Presented by Col. Tytler, Superintendent of Port Blair.

8.—Samples of Hill Poppy Opium, and Poppyseed extract. Presented by Lieut. F. Pogson. These were sent in accordance with the proceedings of the Society at their meeting of 13th August, and were now ordered to be sent to the Government Opium Examiner, with a request to him to report on them.

9.—A selection of seeds from the Punjab Presented by Dr. H. Claghorn. The following is an extract from his letter accompanying them :—

“ I have despatched to your address two small packets of seeds of interesting or useful plants, collected during my late tour in the valley of the *Chander* river. Amongst them is the winged seed of (1) *Trachium wimmerioides*, the Crab Ash of the Himalayas, which is found in the valleys of *Swat* and *Chenab* rivers, at an elevation of 6,000 to 8,000 feet. (2) *Asplenium*, one of the species producing the rhubarb of commerce, which is the *peruviana* of Pongl and other localities in the *tributaries* of the *Chander* river.”

of His Highness the Rajah of Ootunba; (3) *Asphodel* of *Asphodel*, a remarkable plant of the *Asphodel* tribe, occurring in great quantity, covering the hill sides at an elevation of 8,000 to 10,000 feet. The only notice of this showy lily, so far as I know, is in Thomson's *Flora*, p. 343. The scapes are generally four to five feet in height, and are clothed with from one to two hundred yellowish white flowers. In British Lakows it is known as *Kud*, and the young leaves are used as spinach. (4) *Rhus coccoloba*, "*Kakar*," which yields a beautiful wood, used for furniture at Simla and the other hill stations. (5) *Apricot stones* from Cabul. These probably will not grow in Calcutta, but may be acceptable to some of your correspondents."

10.—Six samples of Cotton, the produce of the experimental cotton cultivation at Rangoon, in 1861-62, under the superintendence of Dr. Brandis. Presented by the Government of India. These were accompanied by a following report from Dr. Brandis, to the Secretary to the Chief Commissioner of British Burmah, dated 28th June 1862. —[See Journal.]

The samples and report were referred to the Cotton Committee.

11.—Two samples of Cotton grown by Mr. Langlois, at Akjah. Presented by the Officiating Commissioner of Arracan. (Referred to the Cotton Committee.)

12.—Samples of fibre, leaves, flower, and capsule of *Males Mauritiana*, "*Kanjie*" Vern; also samples of bullock's-heart shrub fibre. Presented by Dr. M. F. Thompson, of Malda.

Respecting the first of these, Dr. Thompson writes:—"The fibre is soft, long, very clean, and elastic. I solicit the favour of your opinion as to its qualities. It is a wild plant, and only used here by the natives medicinally as a safe fever remedy for very young infants." Of the Bullock's-heart fibre he says, "It is largely procurable in the jungles of this district. There is no difficulty in the manner of manufacturing the fibre, as it is done by the usual process of steeping. I have ascertained the value of this fibre in the market here, and find it would fetch a higher price than that of the ordinary 'Bunn' now used by the people. The dealers in flax inform me, that when the common Bunn is selling at two annas per seer, this fibre is worth three annas."

Dr. Thompson also remarks, with reference to the sample of fibre previously received from him, and submitted at the September meeting of the Society:—

"The fibre submitted, a short time ago, for your kind opinion, was obtained from the bark of the cane in its green state; not steeped, but by pounding. I enclose some of the green bark for inspection; it grows in great quantities in this district."

The above specimens were referred to the Fibre Committee for their consideration and report.

13.—Samples of tea and a fibrous bark from Chittagong. Presented by Mr. E. W. King.

14.—A bottle of fresh mignonette seed. Presented by Mr. W. G. Rose.

RECOMMENDATIONS FROM THE COUNCIL.

There being a vacancy in the Council, caused by Mr. S. H. Robinson acting as Secretary, the Council recommend that the same should be filled by Mr. T. H. Moseley, which was agreed to.

The recommendation of the Council, brought forward at last meeting, for the bestowal of a sum of Rs. 250 on Mr. A. Bennett, of Ellengunge, for an essay on cotton cultivation in the Soonderbuns, was confirmed.

COTTON.

The following Reports from the Cotton Committee, on samples referred to them at the August meeting, was next submitted.—[See Journal.]

COMMUNICATIONS ON VARIOUS SUBJECTS.

1.—From Mr. T. Teil, reporting on the acorns of "Ramkota" from Cachar, referred to him at last meeting: to the effect that the specimens received contain no tannin at all, owing, apparently, to their having been exposed on the ground for a long time before being collected; but he adds, "if they could be collected at a proper season, that is, when fully ripe, and immediately they fall or are broken from the tree, I should fancy they would be a valuable acquisition to the tanner in this country." Mr. Teil offers to report on a further supply, if sent down in good condition.

2.—From Mr. A. J. Murray, of Agra, offering the following remarks on steam ploughing:—

"I observe that an attempt is being made to introduce steam cultivation into Bengal, and as I see that very erroneous views are being circulated as to the means through which this revolution in agriculture is to be effected, I trust you will excuse the following remarks.

"The first thing to do is to see in what respects the means and manner of farming in India correspond with English farming. If these means and manner are identical, similar means here will produce similar results. Now the great and essential difference between English and Indian farming is this—in England you can't plough your land unless it is tolerably dry, &c. &c. if power is to be used: in India you cannot plough at all unless your land is thoroughly wet. Now here is a most striking and essential difference, adopting any English tools, as the steam plough, we must see if

by any means, the steam plough can be adapted to such entirely novel circumstances. I will first point out how the steam plough is such a decided success in England, under the new system of farming adopted there. It is essential to be able to plough up your land in October and November, but it often happens that the weather is then very wet, and if any attempt is made to plough with horses, the land is made a shocking mess of by the horses' feet, and the cattle are dreadfully distressed by the heaviness of the work, and in practice the work was never properly done. Now the steam plough avoids the poaching of the land, and also by its superior power overcomes the pastiness of the wet clay lands and gets through a large quantity of work, say six acres per day, by the proper time: thus we see that there is really no competition in England between horses and steam for the autumn ploughing; the horses never did it at all, the steam plough does it effectually. Compare this with the case in India. The great desideratum here is to sow in March and April; oxen cannot plough because the fields are as hard as a stone pavement. Suppose we bring the steam plough, it may, perhaps, be able to get through two or three acres of land, though I suspect there would be several breakages; however, suppose we do get the land broken up, but what have we effected unless we get a seed bed, we are no further than before. Now, every one knows that land treated in this way without water will be of no more use than a new metalled road. Before anything can be sown, you must wait for the rains, and as six hours' rain will do as much as the steam plough, what good is attained by using it?—in my opinion none. The real desideratum is steam irrigation. If any planter can irrigate his land by steam before the rains commence, he will be able to get any number of ploughs cheaply, because all the plough-oxen of the country are standing idle waiting for the rain: besides, as he can commence his sowings whenever he chooses, he can begin six weeks or two months before any one else, and he will also have the advantage of knowing exactly what he can do, and can carry on the manufacturing process during three or four months, instead of having to make a great rush at his work at a time when cattle and men cannot be got.

"I do not wish to discourage those enterprising gentlemen who have imported steam ploughs—far from it; but I wish to remind them that circumstances alter cases, and that the circumstances here are exactly the opposite to what they are in Europe. If they will get a steam engine to irrigate at the same time as they have the steam plough at work, I have no doubt of success; but the steam plough, without water, is useless; in fact is of no more use than a steam-boat on a pucca road.

"I am also informed by gentlemen engaged in the manufacture of indigo, that a large concern requires to be able to plough and prepare several

hundred acres of land within two or three days after the first fall of rain, if this is the case, where would the steam plough be with its six acres per day?"

3.—From the Secretary to Government of Bengal, the following report from Dr. J. Anderson, on *Cinchona succirubra*, dated 9th September last:—

"I have the honour to report to you, for the information of the Lieutenant Governor, that I have succeeded in forming an infusion of the leaves of *Cinchona succirubra* from the plants of that species in the Cinchona nursery near Darjeeling. The leaves fell off spontaneously during the months of June and July.

"I sent the infusion to Dr. Collins, Civil Surgeon of Darjeeling, with a request that he would administer the infusion to some of the patients in the Civil Hospital.

"He has just informed me that he had given the infusion in doses of one fluid ounce to the first four cases of intermittent fever that occurred, and that these patients had been cured without any other medicine whatever.

"This result proves that the infusion of the leaves of *Cinchona succirubra* possesses some of the febrifuge properties of Cinchona; the infusion is of a dark chocolate colour, and is intensely bitter. I hope to be able to submit an account of the chemical analysis of this infusion by Dr. Macnamara, Chemical Examiner to Government."

4.—From the Secretary to the Government of India, applying for a supply of maize or Indian corn seed for the Superintendent of Port Blair.

Ordered to be complied with as far as practicable.

5.—From Dr. Bonavia, Lucknow, requesting a supply of Silk-worm Eggs. He remarks as follows:—

"As I have some two or three thousand plants of the *Morus multicaulis*, and like to commence gradually the introduction of the worm, have you any idea which variety is the most profitable and most adapted to this part of India? I have sent 200 cuttings of the same *morus* to every Deputy Commissioner in Oudh, as a commencement, and shall be able to send as many more in the winter months. With a little perseverance, I hope to see in two or three years, the worm thriving in twenty different centres all over Oudh." (To be complied with).

6.—From Messrs. George Carter and Co., London, forwarding invoices of vegetable seeds, value £205-4-3, and of Flower seeds, value £276-10-9, and forwarding Bill of Lading on a case of Carob Beans for the Society.

7.—From Rev. C. Parish, Moulmein, applying for two Wardian cases of useful plants, and offering to return them to the Society filled with good orchids.

Ordered that Mr. Parish's proposal be acceded to.

The proceedings of last meeting were read and confirmed, and the following gentlemen were elected members.—

J. Robert Sevi, Esq., Major Hugh L. Paster, George Ross, Esq., Captain H. Hales, Major Snow, W. J. Barnell, Esq., Captain H. D. R. Smith, G. R. Willoughby Osborne, Esq., R. F. Stack, Esq., Dr. C. J. Kirwan, Dr. R. Fryer, Captain T. H. Tronson, and Captain W. J. White.

The following gentlemen were proposed as members :—

1.—Amian Thomson, Esq, Judge, S. C. Court, Kishnaghur;—~~proposed by~~ Mr. J. Scott Elliot, seconded by Mr. W. G. Rose.

2.—Thomas Owen, Esq, Solicitor, Calcutta,—proposed by the Acting Secretary, seconded by Cower Hurrender Krishna Bahadoor.

3.—Captain T. C. Hamilton, District Superintendent of Police, Akyab;—proposed by Major F. W. Ripley, seconded by Mr. A. Grote.

4.—Dr. Thomas Dillon, Political Agent, Munnipore,—proposed by Mr. A. Grote, seconded by the Acting Secretary.

5.—Captain H. Hyde, Bengal Engineers, Mint Master, Calcutta;—proposed by Mr. H. E. Braddon, seconded by Mr. R. Blechynden.

The following contributions were announced :—

1.—Notes on Cotton Farming, by Dr. R. Wight. Presented by the Government of India.

2.—A sample of Cotton grown from Egyptian seed in Balasore. Presented by W. Carnell, Esq., Officiating Collector of that district. Referred to the Cotton Committee.

3.—Samples of Cotton from New Orleans seed, and of thread and napkins manufactured therefrom, prepared by the Lucknow Jail prisoners. Presented by J. W. Ganga, Esq., Inspector of Prisons, Oude. Referred also to the Cotton Committee.

4.—A set of plants and a packet of seeds from Melbourne. Presented by Mr. Pitt. The following is extract from his letter :—“ I regret that

6.—A skein of Native Silk and a sample of ornamental wood from Munnipore. Presented by Dr. T. Dillon, Political Agent, to the President. Respecting the wood, Dr. Dillon writes :—" I send you a specimen of a most beautiful wood I have found here. I think it is a Rose wood, but, polished, it is perfectly black like old Mahogany. "

It was decided that Dr. Dillon should be asked to forward a cocoon of the Silk and to state the market value for the guidance of the Silk Committee.

7.—A collection of plants from Bourbon. Presented by Captain Boursemiche through Dr. Tonnerre.

8.—Some Cocoanuts and Yams from Pinang. Presented by Mr. H. J. Butler.

Recommendation from the Council.

The following recommendations from the Council were laid before the meeting and unanimously adopted :—

1.—That the arrangements for the supplies of Garden Seeds for 1863 be referred to the Nursery Garden Committee for consideration and report.

2.—That Messrs. W. G. Rose, W. Haworth and W. Eames, be requested to form a Committee for examining and reporting on the two ploughs presented to the Society at last meeting.

The meeting, in confirming the last recommendation, also agreed that the Committee be requested to report on the ploughs as compared with the plough of Tirhoot in use by the planters.

It was also resolved that Messrs G. Ackland and J. McGavin be requested to join the Fibre Committee.

COTTON.

The Secretary having mentioned that numerous enquiries had been made for copies of Mr. Bennett's Essay on 'Cotton Cultivation,' recently published in the Society's Journal, it was resolved that the Society should order 250 copies of the Essay to be printed, and that any profit arising from the sale thereof should be held available to Mr. Bennett.

The Manchester Cotton Supply Association having, in September 1860, placed at the disposal of that Society two gold and six silver medals as prizes for successful Cotton cultivation, and one of the gold medals having already been awarded to Dr. J. Shortt, for his Prize Essay on Cotton Cultivation from Exotic Seed, it was now resolved, on the recommendation of the Council, that the remaining gold medal be offered to the successful candidate for the Government prize for Cotton cultivation in 1863, and that the same be advertised accordingly ; and that the six silver medals be held available to contributors to the Society's Journal on the subject of Cotton cultivation, and that the Cotton Committee be requested to recommend the most deserving parties ; but, in the opinion of the Council, the preference should be given to those contributors who have also experimented practically in the cultivation.

COMMUNICATIONS ON VARIOUS SUBJECTS.

1.—From J. H. R. Carnac, Esq., Assistant Secretary to the Chief Commissioner of the Central Provinces, enclosing the following copy of a letter from the Chief Commissioner, requesting the co-operation of the Society in the object therein detailed :—

“ 1. I am directed by Officiating Chief Commissioner to request your attention to the subject of introducing the culture of Sugarcane into the districts of your Division.

2. You are aware that, until within the last few years, the cultivation of Sugarcane in the Nerbudda valley was perhaps as rare as it is now in the Nagpore province, and the advantages of its introduction into the Jubbulpore and Saugor Divisions have been very great. Some Sugarcane is cultivated in the Nagpore districts, but it is of a poor quality. Two objects are therefore before us, *viz.*, to increase the culture and to improve the quality. Towards both these objects Officiating Chief Commissioner believes that by the judicious influence and legitimate assistance of the local authorities much may be gradually effected.

3. The soil of many parts of the districts in your Division is probably well suited for the growth of Sugarcane. It is rich, and, if means of irrigation be developed, it would probably produce good Sugarcane.

4. In regard to quality or description of Cane grown, I am to suggest that you enquire from competent quarters, *firstly*, the kinds best suited to the soil and the agricultural appearances here; and, *secondly*, from whence specimens of superior and suitable kinds can be obtained. You would doubtless be aided in this if you placed yourself in communication with the Agri-Horticultural Society of Calcutta, the Depôt at Seharanpore, the Commissioner of Mysore, and even the Jubbulpore authorities.

5. Officiating Chief Commissioner trusts that some advance may be reported in this matter by the time the next Annual Revenue Reports become due.

A letter from the Officiating Commissioner of the Nagpore Division, enquiring whether the Society could assist the object in view, was also read. Resolved, that such varieties of Cane as are available in the Society's Garden should be offered to the Chief Commissioner free of cost.”

2.—From Dr. Dillon, Political Agent, Mannipore, from which the following extract was read :—

“ As regards the cultivation of Cotton here, some write that the quality of the soil has much to say to the quality of the staple. There is a remarkable feature in the soil here, which, to the same extent, I have not observed elsewhere—that the bricks (unburned) made from the clay when dried is so hard, that it requires a smart blow of a hammer to break them, and this clay is of a brownish colour, decidedly rich soil, and resembles, as far as I can judge, the cane-brake soil of Alabama: it can be almost polished when dry. I am very anxious to commence,

the cultivation of Cotton, and if it succeeds, as I feel it will, it would be a source of immense good to the country and to the unemployed population here and the hills about. There are large valleys extending for hundreds of miles on all sides, most fertile, I understand. I will establish an experimental garden here, and the natives are quite civilized and intelligent enough to send men to learn its culture, and they would eventually prove dexterous in its preparation. I should feel obliged for any information on the subject or being put in the way to get it."

Dr. Dillon also mentions that in Munnipore the Mulberry tree flourishes luxuriantly, and that there are thousands of acres of indigenous Tea of the most splendid kind; also India-rubber; and that he hears that Coffee is in great abundance in the South, and that Cotton—New Orleans seed—sown in the sides of the Hills could grow well.

8.—From Mr. C. Maddox, dated Goa, 12th October, who writes as follows:—

"Your favour of the 16th August I have just received here, at which place I have lately arrived. The cause of my being here will be explained by the subsequent portion of my letter. I am sorry that any accident should have caused the small case I sent to have been delayed; but I was assured by the Agents of the Peninsular and Oriental Company at Penang that it would be delivered within two days after its arrival at Calcutta. I am indebted to the Council of the Society for their courteous consideration in admitting the Essay I sent for competition. When I was at Singapore some short time before, it was decided to try the experiment of planting Cotton in the Straits Settlements. I was introduced to Mr. D'Almeida, the Portuguese Consul General, whose father, some years before, tried the experiment of planting Cotton in Singapore, but had not met with success. He was of opinion that there were causes which would not allow of its being profitably made anywhere in the Straits Settlements, but mentioned the territory of Portuguese India as being one of the most promising places for its trial. Being determined to give the Straits a fair trial, the plantation at Province Wellesley, of which I have given you an account, was established, and the essay sent contains an account of the proceedings there and the results of the same up to the time of my sending it to you. During the months of May and June last there was an unusual fall of rain compared with the two preceding years, so much so, as to lead me to believe that Cotton could not be made with any *certainty* to yield a profit: that it can be made, sufficient proof is to be found in the fact of several bales having been shipped to England from there. This want of definition of seasons not allowing any certain calculation to be made for fixing the proper time for the picking of the Cotton, in combination with the small area of land suitable for its growth, led me to look for a larger and more certain field for the employment of time and capital. I addressed a letter to the Governor of Portuguese India, requesting him to give me all the information he could, that I might

form an opinion of the place recommended by Mr. D'Almeida. I received an early answer from him, in which he represented the land as being very suitable for its growth, and also stated that, although its culture had never been pursued there, a small quantity could be found growing in many places. He regretted there had been no attempt made to make it an article of commerce there, and concluded by assuring me that the Government would make very liberal terms with any person who would introduce its culture. After mature consideration, I resolved to leave the plantation at Province Wellesley in the hands of an overseer and proceed to Goa to judge for myself whether it was a desirable place for commencing a plantation or not. I arrived here (having first had to go to Bombay to obtain a vessel for Goa) about the beginning of September last, and after an examination of land, and various difficulties were overcome, completed a contract (in conjunction with an American gentleman from Georgia, an old Cotton-planter) with the Government for a tract of land comprising more than 60,000 acres, of which I should think nearly one-third will be available for Cotton. The whole of the country is very freely watered; there are several ranges of mountains on our Estate suitable for Coffee; and in the valleys and plains very fine land for Cotton cultivation. We have obtained the land for a term of 50 years, and trust it will become a very prominent place in the list of returns from all countries. The river, about four miles distant from the Estate, is navigable all the year for large cargo boats, and distant from the place of shipment about twenty miles. The port charges are much less than at Bombay, and the roads leading to the river are to be maintained in good order at the Government expense: the rent is merely nominal. The Governor, a man of great foresight, wishing to develop the natural resources of a fine country, which has long lain in a dormant state, has made concessions to the utmost of his power, in consideration of our being the first to open a new branch of industry for the country. I am not able to give you any detailed particulars of the Estate at Province Wellesley, as you desired, from the causes I have explained above. I received a letter from the Agents of the Estate about three weeks since; the picking was going on and would be shortly finished; but I cannot, as I have not been furnished with the quantity, give you the information I should wish to do. In the hope of soon having the pleasure of hearing from you, I remain, &c."

Resolved, that Mr. Maddox be requested to procure from his Agent at Singapore a report of the result of his Cotton crop there for the information of the Society

4.—From Br. Bonavia, Lucknow, asking for information as to the composition of the soil, a sample of which was forwarded with his last Cotton samples. *Resolved*, that Mr. Tween, Chemical Analyst of the Government Geological Museum, be asked to report on the specimen.

5.—From J. Brind, Esq., of Hope Town, announcing the formation of a Branch Agricultural and Horticultural Society at Darjeeling.

(Wednesday, the 17th December 1862.)

A. Grote, Esq., President in the Chair.

The proceedings of last Meeting were read and confirmed, and the following gentlemen were elected members :—

Amian Thomson, Esq., Thomas Owen, Esq., Captain T. C. Hamilton, Dr. Thomas Dillon, and Captain H. Hyde.

The following gentlemen were proposed as members :—

J. Stalkart, Esq., Goosery ;—proposed by Mr. W. Haworth, seconded by the Acting Secretary.

F. A. Goodenough, Esq., Merchant, Calcutta ;—proposed by Mr. S. P. Griffiths, seconded by Mr. C. E. Creswell.

T. R. Grant, Esq., Merchant, Calcutta ;—proposed by Mr. S. P. Griffiths, seconded by Mr. C. E. Creswell.

C. S. Simons, Esq., Tea Planter, Nazerah, Assam ;—proposed by Mr. A. Grote, seconded by the Acting Secretary.

The following contributions were announced :—

1.—Memoirs of the Geological Survey of India, Vol. iv., Part 1, and Palæontologia Indica, Series 2, Parts 1 and 3. Presented by the Government of India.

2.—Report of the Conservator of Forests, Madras, for 1861-62. Presented by the Government of India.

3.—Journal of the Society of Arts and Sciences of Batavia for 1857 to 1860, and copy of Broto Joida, a Javanese Epic poem, with translation into Dutch. Presented by the Society.

4.—Two samples of Cotton from New Orleans seed grown at Rangoon. Presented by Dr. T. Brandis. Referring to these Dr. Brandis writes :—

I have the honor to transmit two samples of Cotton, of this year's growth, from the Government Cottons garden, Nyongnechen, near Myodwin.

(1.) New Orleans seed, third season. *Sown 19th June, gathered 9th October.*

(2.) Ditto ditto ditto with seed ditto.

*2. The seed was originally received from you in 1860, and the produce does not seem to have degenerated. I send these samples in anticipation of a larger quantity which will be forwarded through the regular channel later in the season, when the picking shall have been completed.

5. Samples of a fibre and stalk from a plant growing in abundance at Jugdespore, Shahabad. Presented by Messrs. Thomson and Wyllie, who request an opinion on its commercial value. These gentlemen to be requested to forward some further particulars respecting the plant before submitting the specimens to the Fibre Committee.

6.—A box of South African seeds from the Cape of Good Hope Botanic Garden Presented by Captain W. H. Lowther, who suggests that the climate of Bengal would probably be too damp for them and that they might be sent to the Hill

Stations of the three Presidencies. Captain Lowther's suggestions to be adopted.

7.—An Essay on Indigo culture and manufacture. Presented by the author, Dr. J. Short, of Chingleputt, Madras. A prize of Rs. 800 was awarded by the Madras Government for this Essay in 1860.

8.—Three cases of Burmese Orchids. Presented by J. L. McMillan, Esq.

9.—A collection of Orchids from the Andamans. Presented by Captain Trouson.

10.—A specimen of Chittagong Tea from Mrs. Elson's Garden. Presented by J. G. Balfour, Esq.

11.—A specimen of Dacca Tea. Presented by Colonel E. F. Smith.

12.—Seed with Cotton of the Monfonga *Bombacospermum*. Presented by R. Riddell, Esq., who writes concerning it as follows, under date the 8rd November 1862:—

In the course of my duties at the International Exhibition I found, in the Natal Commissioner's Department, a curious kind of Cotton: as the seed was of a light brown color, I was induced to investigate it more closely and brought it to the notice of our jurors. It is the first of the kind ever seen, I believe, in England. Though the fibre is short and coarse, it can be used for many purposes, and a medal has been awarded for it. Like many of the fine Cottons, it seems to be attacked by an insect drawn to it from the oil it must contain. I have thought perhaps you would like to possess some and send here with a small quantity. Do try and see if you can get any to vegetate, and, if so; perhaps it may become useful: it is called by the inhabitants of Natal Monfonga; "*Bombacospermum*" by Prest; it is also said to grow in the Brazils and Mexico.

I have succeeded in raising three plants, each now near a foot high, and they are in the Royal Botanical Garden, Regent's Park.

GARDEN SEEDS FOR 1863.

The following Report of a Special Committee, appointed to consider the important subject of the Society's supplies of seeds for 1863, was then read. The Report having already been before and adopted by the Council, it was now unanimously approved by the Meeting and ordered to be published in the proceedings.

Report of the Nursery Garden Committee, assisted by the Floricultural and Fruit and Kitchen Garden Committees, adopted at a Meeting held on Friday, the 5th December 1862, for the purpose of considering the best arrangements for procuring the Society's supplies of garden seeds for the year 1863.

The Committee having considered the reports submitted to them of the trials of last season's seeds in the Society's Garden, and the numerous complaints of the failure of Messrs. Carter and Co.'s vegetable seeds from all parts of the country, beg to recommend to the Council as follows.—

1.—That the usual assortment of American Vegetable seeds be ordered from Messrs. Landreth and Sons, with the exception of the beans, of which only half the quantity imported for 1862 should be ordered.

2.—That of the English Vegetable seeds half the supply be ordered from Messrs. Carter and Co., and half from some other first-class English Seedsmen, to be selected by the Secretary, Mr. Blechynden, from the list furnished by Mr. Errington, for any other that Mr. Blechynden may prefer, and that he be also requested to inspect the seeds, both from Messrs. Carter and Co. and the new suppliers, previous to their being packed for shipment.

3.—That the usual assortment of Flower seeds be ordered from Messrs. Carter and Co. only.

4.—That a similar supply of agricultural Seeds to those imported in 1862, be also ordered from Messrs. Carter and Co.

5.—That 700 packets of each kind of Vegetable seeds and of Flower seeds be ordered, and that, in dividing the order for English Vegetable seeds between Messrs. Carter and Co. and another firm, each be requested to make up the usual *assortment* of Seeds, but to send half the usual quantity; except as to the peas, of which, in lieu of dividing the usual quantities by measure, each be requested to send two instead of four varieties, and each to send different kinds.

6.—That the seeds be shipped as follows:—Messrs. Landreth's seeds to arrive here about August, as usual. Of Carters and Co.'s and the new supplier's Vegetable seeds, *all* the small kinds to be shipped by mail steamer leaving Southampton on 6th July; and of the peas and beans, half to be shipped in the 6th July steamer (for the up-country members), and half by steamer of 20th August (for the Bengal members). Messrs. Carter and Co.'s Flower seeds and agricultural seeds to be shipped, half by steamer of 6th July, and half by steamer of 20th September.

7.—That no peas or beans be sent out in bulk, but that all be made up into member's shares in proper packets, and the same with the Flower seeds, so as to entail the least possible exposure to the damp air when packing them in Calcutta for forwarding to their destinations.

COTTON.

The following Report of the Cotton Committee on samples of Cotton submitted at the October Meeting of the Society was then submitted. The samples under report were—

Six from the Government experimental cotton cultivation at Rangoon, received from Dr. T. Brandis.

Three from the Commissioner of Arakan of Cotton grown by Mr. Langhois, and from Mr. Mercer, of Futtchgurh, of native Cotton grown there by him.—(*See body of the Journal.*)

A Report was submitted from Dr. Bonavia on the second or summer crop of foreign Cotton raised from seeds supplied in 1861, and grown at Lucknow;—referred to the Committee of Papers for publication in the Society's Journal.

The Society's Prize Essay on Cotton Cultivation by Dr. Shortt being now in course of distribution to members, it was resolved, on the recommendation of the Council,

that copies should be available to the public at 8 annas per copy; also that 20 copies be presented to the Manchester Cotton Supply Association, and that they be informed of the intentions of the Society with respect to the distribution of the Association's remaining gold and silver medals as determined at the last Monthly Meeting.—Also that Mr. Bennett's Essay or hand-book on Cotton Cultivation should be offered for sale at 8 annas per copy, and that both Essays be advertised for sale by the Society accordingly.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following communications were also submitted :—

1.—Letter from the Secretary, dated London, 3rd November 1882, who writes as follows :—

"Among the various machines included in the International Exhibition there are four which appear to me deserving of attention as more especially applicable to India, and under this impression I trouble you with a few lines respecting them, and send by this opportunity, under a separate cover, certain printed papers and pamphlets relative thereto, which will, I think, afford full information to all interested in Cotton and fibre-yielding materials."

"1st.—*Cotton Roller and Sawgins*. You are aware, from the experiments made at intervals, for several years past, by Committees specially appointed by our Society, that every imported machine, in the shape of a *roller gin*, for *short-staple Cotton*, has failed to answer expectation, consequent on *slowness of action*. I witnessed the working of a machine, on the roller principle, the other day, at the Exhibition, which labors less under this defect, inasmuch as it is warranted to turn out, in a day of 12 hours, about 216lbs. of clean Cotton (Indian Surats). I observed that this machine separated the fibre completely from the seed without injury, so far as I could see, to the staple. The machine in question is called the "Double-Acting Macarthy Gin." The papers sent separately, marked 1, 2, and 3, afford sketches of this machine, the mode of construction, and quantity of work it can perform. The self-feeding lattice attached to the machine is certainly a great improvement on the original Macarthy gin. It is, however, a more complicated machine and higher priced (cost £10), and this is a drawback; but then, on the other hand, it is not likely to get readily out of order, if common care and attention be bestowed on the working of it. It is not, of course, a machine such as a native ryot can afford to purchase, though it may not be, *comparatively*, much more expensive than the best description of native *churka*. Machinery of this nature must be confided to European superintendence to work off "*kupass*" purchased from the native cultivator. It is a question whether any really effective machine, on the roller principle, can be constructed at a sufficiently low figure for the native cultivator to purchase. While I was present the machine in question cleaned a quantity of Surat Cotton and Cotton raised in India from New Orleans seed. The complete freedom from injury to the staple, vanished for by Messrs.

Fairbairn and Fothergill (see their Report, dated April 1862, to the Cotton Supply Association, introduced on paper No. 2), is much in favor of this machine, which is the best of the kind I have had an opportunity of seeing."

"The other machine to which I wish to draw attention is on the *sawgin* principle; the only one of this character in the Exhibition. It is shown by Messrs. Emery Brothers, of Albany, New York. I saw this machine at work on Surat Cotton; it operated very speedily, and with, apparently, very little, if any, injury to the staple. I refer you to papers 4 and 5 for full information respecting this machine."

"The one I saw is of 35 saws, price £30, and will turn out, according to the published statement, about 1,000 lbs. of clean Cotton per day of 10 hours. It is similar, as respects the diameter and general character of the saws, to that fine machine in our Society's museum which was submitted by Messrs. Carver and Co. of Massachusetts, and gained the prize offered by the Government of India through the Society. (See Journal, Vol. viii., p. 4.) I believe Messrs. Carver and Co.'s machine consists of 30 saws, costing also about £30, but I write under correction, and will clean 355 lbs. per day of 10 hours. The "improvement" in this machine consists in a spiked roller to feed in the Cotton to the saws, and which seems to assist the working. It has also a condenser and cleaver, which is simply an attachment for the gin, and is charged for separately. These make the machine much more bulky, and might be dispensed with, I think, without detriment to its efficiency. I believe that our Society had a report on the Cotton cleaned by Carver's machine, to the effect that it did not injure the staple: if a similar report can be given on the Cotton passed through Emery's gin, it will be seen that, considering its price, the amount of work performed, and its simplicity of construction, it is a machine well deserving of encouragement by those interested in Cotton cleaning in India."

"2nd.—*Two Machines for dressing of flax.* These are patented by Messrs. Sanford and Mallory. I saw them both at work in the Exhibition. You will find full particulars respecting them in papers 6, 7, 8, and 9. They both do their work well. The cost of the "flax machine" is £35; it will turn out from 120 to 130 lbs. of clean fibre per day; *will work flax either retted or unretted*, the straw requiring no previous breaking. This machine should prove of service, in the Punjab especially, and in parts of Upper India suitable for flax growing. The "fibre machine" is of more pretensions, and at a greater cost, namely £45. You will observe it stated that it can dress all kinds of fibre-yielding plants, including China grass (*Rhœn*) and New Zealand flax. I was informed by Mr. Guild, who has charge of these machines at the Exhibition (and who appears to be an intelligent, practical man), that he has received orders for several of the last-mentioned machine from persons resident in Bengal, with the view of operating on the *Rhœa*. He informs me he has not had an opportunity of fairly testing the machine with this plant, not having been able to get any *green* stalks of it, but he

seems very sanguine of success with it. But this will be put fairly to the test on the arrival of the machine in your quarter. I hope it may answer the purpose, and thus bring into the market of England the finest fibre, in the world; but it does not necessarily follow that, because it operates successfully on the agave, aloe, pineapple, yucca, and all such white fibres, it will work well with the *Rhees* which, as you are aware, has hitherto baffled all attempts at extraction of its fibre speedily and economically, and without detriment to its strength, so superior to all other known fibres. If it can really perform this, it will be indeed one of the most valuable machines ever imported into India."

"You will have read the recent discussions about the *Zostera marina* as a substitute for Cotton. I fear there is not the least chance of its being turned to so profitable an account, as it does not possess the necessary staple."

On reading the above, it was agreed that one of the improved "double acting Macarthy's gins" be ordered at once for the Society, to be kept as a model for those interested in the subject of Cotton cleaning.

2.—From R. Riddell, Esq., in continuation of his letter above quoted, the following remarks on *Sapota Mullieri* :—

"The *Sapota Mullieri* juice, which I wrote you some time ago about, has been tried by several of the India Rubber and Guttapercha manufacturers, and has been pronounced a very valuable substance. It possesses in some degree the properties of both; it is elastic, can be vulcanized, and forms what is termed Ebonite. I wish I could send you seed, but the oil it contains renders it soon bad, turning rancid: the tree grows in thousands in British Guiana, and the wood is used for furniture: it is something like Mahogany."

8.—Read the following Report from Dr. Mactier, on the Hill Opium submitted to the Society by Lieutenant Pogson at the October Meeting:—

"I regret the delay which has taken place in replying to your letter of the 30th October, regarding Lieutenant Pogson's Hill Opium and Extract of Poppy Heads. The former is a very fine specimen of the drug, of a rich chestnut color, like most samples of Hill Opium. It contains 7·327 per cent. of Morphia, or just twice as much as Patna or Benares Opium."

"The Poppy Head Extract is a dark-colored mass of a close texture, and of the consistence of a firm extract; it has an agreeable smell, somewhat like extract of Hyosciamus, but not a trace of the characteristic odour of Opium. The taste is also sweetish and pleasant, but quite unlike that of Opium. I subjected this substance to a series of experiments, but failed in obtaining even a trace of Morphia. I also sent a small portion of it to Dr. Macnamara, Chemical Examiner to Government, and he likewise failed to satisfy himself of the presence of Morphia."

4.—Letter from the Secretary to the Acclimatization Society at Melbourne, reporting that the Erie Silk-worm Eggs received by the Society had perished on the route. On the advice of Mr. Blyth, it was resolved that a further supply should

be sent in a case with some castor-oil plants, so that the worms might find food on their being hatched on the route.

5.—Letters from the Secretary to the Government of Madras and from Dr. Shortt, acknowledging the safe receipt of the gold medal and remittance of 1,000 rupees, the prizes for Dr. Shortt's Cotton Essay.

From Captain Salmon, mentioning that the beans he had received from the Society all failed, until he tried the experiment of soaking them in cold water for 24 hours before sowing, after which they vegetated freely.

R E P O R T

Agricultural and Horticultural Society OF INDIA.

*Report from the Council to the Annual General Meeting of the
21st January, 1863.*

The Council in submitting their usual Annual Report have again the satisfaction to notice the steady increase in prosperity and public support enjoyed by this Society.

From the usual Tabular Statement, given below, it will be seen that the accession of members during the past year has been 104, from which deducting the decrease from deaths, resignations, and removals, 66, the number of members at the close of the year stands at 882. Of these 33 have compounded for their subscriptions, 141 are absent from India, 16 are Honorary, Associate, and corresponding, and 693 are actual paying members.

Report of the Agricultural

CHARACTERIZATION.	In 25 previous years.	In 1846.	In 1847.	In 1848.	In 1849.	In 1850.	In 1851.	In 1852.	In 1853.	In 1854.	In 1855.	In 1856.	In 1857.	In 1858.	In 1859.	In 1860.	In 1861.	In 1862.	Gross Total.	Total real number at close of 1862, after deducting lapses.
Honorary Members,	11	1	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	18	9
Associate Members,	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	5
Corresponding Members,	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	6	9
Civilians,	232	13	15	22	8	10	22	16	18	6	23	23	17	19	28	28	23	13	535	303
Merchants & Traders,	201	14	12	13	10	14	20	12	5	16	18	31	11	20	15	18	17	19	466	155
Indigo and other Tropical Agriculturists,	190	15	6	5	1	9	19	13	10	7	14	12	10	14	20	15	15	21	398	140
Military Officers, ...	160	10	11	11	11	9	34	18	22	19	26	22	12	14	27	38	26	25	495	187
Medical Officers, ...	80	0	2	3	5	9	4	5	3	4	6	9	3	3	16	11	6	7	174	63
Artists,	63	2	14	5	6	9	8	8	8	5	5	7	14	19	4	6	8	3	194	63
Clergy,	14	1	0	0	0	2	1	1	1	1	2	1	2	0	0	0	0	0	27	6
Law Officers, ...	40	1	0	0	0	4	6	3	1	3	6	3	1	5	2	1	2	4	87	24
Miscellaneous, ...	9	0	6	0	2	2	6	0	0	10	0	0	2	7	5	5	0	12	62	35
	1,002	58	62	60	49	67	122	78	69	72	100	109	72	102	118	123	97	104	2,404	882

Amongst so large a body it must be expected that death will claim his periodical deduction from the list, though the number for the past year was found less in proportion to the number of members than in previous years, being 15 only. Amongst them Mr. James Hume, who was formerly, for 8 years, Honorary Secretary to the Society. The other members deceased were Mr. W. Ritchie, Messrs. C. H. West, C. Durschmidt, F. R. Moultrie, R. E. Cunliffe, A. K. King, H. Mead, G. M. Gasper, and David Andrew, Major Lieut Campbell, Captain J. DeSinclair, Rajah Prosononauth Roy, Baboo Ranapershah Roy, and Prince Mahomed Ruffeecoodeen.

The usual Financial Statements will be found appended. The principal feature they exhibit, as compared with former years, is the large amount of members subscriptions in arrear, amounting to Rs. 12,866-1-being Rs. 2,763-8-3 more than on 31st December 1861. This is partly accounted for by the increase in the total number of Members, and the gradual accumulation of long standing arrears of subscription, dating from 1853 and amounting to Rs. 2,857-5-6-including Members who are in arrears for the part or whole of 1861; a considerable portion of which sum the Council apprehend will have to be written off as loss. The vested fund of Rs. 20,333-5-4. remains unincumbered except with a loan of 1,500 Rupees from the Bank of Bengal taken out in June last.

In agricultural matters,—the necessities of the mother country with respect to supplies of Cotton, in consequence of the continued blockade of the South American Ports, have continued to invest this article with peculiar interest throughout India, and it has formed the most prominent subject of the Society's attention during the past year. In co-operation with the Manchester Cotton Supply Association, through their Calcutta Agents, Messrs. Mosley and Hurst, who have shewn much zeal in the cause, they have been engaged in distributing seeds and disseminating information to Members and others who have engaged in the cultivation with various success. In these pursuits, whilst increasing the quantity grown, the main object is to improve the quality of Indian cotton without materially adding to its cost of production, and it is evident that much remains yet to be learnt before this desideratum can be obtained. As the superintendence of Europeans in the different stages of cultivation and after

preparation must prove a main element of success in this direction, the Council may congratulate the Society on the recent concessions by Government, to those who desire to invest their labour and means in the cultivation, by the permission to obtain and hold waste lands under a good and inalienable title. The Government orders on this question are of too recent a date to have produced as yet any practical benefit, but the Society may look upon this measure as promising to be one of the greatest future benefit to the agriculture of the country, from the encouragement it will afford to Europeans to engage in the cultivation of cotton, and still further to extend that of Tea and other valuable agricultural products.

The Society's prize of 1,000 Rs. for an Essay on cotton cultivation in India from foreign seed, has been awarded to Dr. J. Shortt of Chingleputt, the Manchester Cotton Supply Association contributing half the above amount and adding their Gold medal for presentation to the successful candidate. Five essays were sent in for competition, no one of them without considerable merit; and the Society, by the permission of the authors, are publishing three of them, in addition to that which gained the prize, in their Journal.

In their capacity of promoters of Horticulture the Society held their usual flower and vegetable Shows in January, February, and April; these were of average merit, and the Society distributed to the competitors 1,125 Rupees in prizes, viz 756 Rs. for vegetables and 369 Rs. for flowers.

The usual supplies of Garden and Field crop seeds were also imported from Messrs. D. Landreth and Son of Philadelphia, and Messrs Carter and Co. of London, and distributed to members, the total value being Rs. 10,055. The American seeds were, as usual, successful, but the vegetable seeds from Messrs. Carter and Co. proved partial failures from some cause not satisfactorily accounted for. The whole subject was referred to a Committee of the Council in November, on whose recommendation some changes have been ordered with respect to the selection, packing, and time of importation of the English seeds for 1863, which it is hoped will ensure for them a more successful result than for those of the past year.

The advantages offered to Members by the Society's Nursery garden in the distribution of fruit grafts, and ornamental plants

have been largely availed of during the past year, 8,253 plants in all having been distributed to all parts of the country, and a large stock is now accumulated to meet future indents, including 6,882 fruit grafts. The Society has also exchanged plants with the Horticultural Societies of Melbourne, Sydney, and Bombay, the Superintendent of Port Blair, and Mr. McMillan of Akyab.

An experienced Gardener, Mr. R. Errington, was engaged by the Society in England, and arrived here in March, and the Council have every reason to be satisfied with his management of the Nursery Garden.

The Secretary, Mr. Blechynden, being desirous of visiting England, obtained from the Society a year's leave of absence from July last, delegating the acting duties of his office to Mr. S. H. Robinson, who had formerly in 1854-55 occupied the same post for a year. Meanwhile Mr. Blechynden's sojourn in London is being availed of for the judicious selection of plants and implements for the Nursery Garden, and for information on the many recent improvements in machinery connected with agriculture and the preparation of agricultural products.

Two numbers of the Journal have been published during the year, Parts II and III of Vol. XII, besides Dr. Shortt's prize Essay above referred to which forms Part IV and completes that volume. These contain the Proceedings of the Society, and render unnecessary any detail in this Report of the various other matters which have engaged the Society's attention.

Statement of Receipts and Disbursements of the Agricultural and Horticultural Society of India from 1st, January to 31st, December 1862.

RECEIPTS.

From Members, Subscriptions collected during the year,	17,960	8	3
„ Government Annual Donation	5000	0	0
„ His Excellency the Earl of Eglinton's Annual Donation for the year 1862,	500	0	0
„ Bank of Bengal a Loan on deposit of 4 Government promissory Notes Rs. 2600,	2600	0	0
„ Ditto amount of Interest on Loan Rs. 1500 refunded having been drawn in excess,	2	10	9
„ Honorary Agents Manchester Cotton Supply Association for their half of prize for Cotton Essay,	500	0	0
			<hr/>
	8602	10	9
„ Accruings of Interest on Government Notes,	761	5	4
„ Proceeds of Sea Island cotton seed,	2	0	0
„ Ditto of 10 maunds of Potatoe seed,	70	0	0
„ Ditto of Sugar canes delivered from the Nursery Garden, ..	45	8	0
„ Ditto of 3 Bullocks from Ditto,	34	0	0
„ Ditto of Fruit grafts from Ditto,	1041	1	3
„ Ditto of a Plough,	35	0	0
„ Ditto of Cotton cleaning Machines,	49	0	0
„ Ditto of a portion of surplus Cape, American, English and Native vegetable and English flower seeds of, 1861-62 ..	1335	0	0
„ Ditto of copies of publications of the Society,	175	4	0
„ Ditto of old seed boxes,	10	0	0
„ Ditto of Linseed,	18	11	0
„ Members, amount for glazed cases, pots and packing charges for seeds &c.	1189	13	9
„ Members, amount repaid for freight on boxes of seed &c. forwarded in, 1861-62	319	6	9
„ Amount of contingent expenses refunded by Head Gardener, ..	510	0	0
			<hr/>
	4691	11	9
Total Receipts Rupees	51616	4	1
Balance in the Bank of Bengal on 31st, December, 1861	639	15	0
„ Ditto in the hands of the Secretary on Ditto,	10	1	3
			<hr/>
Grand Total Co's Rs.	51964	4	4

DISBURSEMENTS.

By Messrs. D. Landreth and Sons for American Garden seeds supplied in 1860-1861,	4096	6	0
„ Messrs. James Carter & Co. in part of their Bill amounting to £ 312 for English Flower seeds, supplied in 1861, ..	1140	4	3
„ Ditto in full of their Bill amounting to £ 184-18-6 for Agricultural seeds supplied in 1861,	1853	1	6
„ H. Cope Esq. for a box of Cupressus torulosa seed,	17	0	0
„ Cash purchase of 12 Mds. of Potatoe seed,	94	0	3
			<hr/>
	7150	0	0
Carried over, Co's Rs.,	7150	0	0

Statement.

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LIBRARY.

	Brought forward, Co.'s Rs.,...	7120 0 0
By Books purchased during the year for the Library, ..	146 14 0	
„ Binding books during the year, ..	28 0 0	
	<u>174 14 0</u>	314 12 0

PRINTING.

„ Sundry parties for printing receipts and Schedules for prizes for flower shows &c, &c, ..		74 0 0
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JOURNAL.

„ Bishop's College Press for Printing &c. 700 copies of Journal part 2, Vol. XII, ..	591 2 9	
„ Calcutta Printing and Publishing Press, for printing appendix to the above, ..	127 9 0	
	<u>718 12 9</u>	

NURSERY GARDEN.

„ Ordinary expenses incurred on account of the Nursery Garden from 1st December 1861 to 30th November 1862, ..	3130 14 5	
„ Extra expenses incurred for purchase of fruit seedlings for grafting, for glazed cases, pots, and Gardener's Outfit, and for sundry other contingent expenses, ..	2228 5 0	
„ Capt. W. H. Lowther for Bulbs and plants &c. from South Africa, ..	100 0 0	
	<u>7544 2 2</u>	

ESTABLISHMENT.

„ Amount for Establishment from 1st December 1861 to 30th November 1862, ..	3953 6 0	
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PRIZE ESSAY.

„ Dr. John Shortt, for Prize Essay on cotton cultivation in India from Foreign seed, ..	1000 0 0	
„ W. Bennett Esq. for an Essay on cotton cultivation, ..	250 0 0	
	<u>1250 0 0</u>	

PROVINCIAL REWARD.

„ Prizes to Malles for Vegetables and fruits at Exhibitions held on the 29th January, and 26th February, and 16th April 1862, ..	723 0 0	
„ Ditto to Ditto for flowers at Ditto Ditto, ..	309 0 0	
	<u>1032 0 0</u>	

COTTON.

„ Messrs. Fischer & Co. proceeds of 2 bales of Bourben Cotton sold by Manchester Cotton Supply Association, ..	304 0 0	
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ADVERTISEMENT.

„ Advertising notices of General Meetings, of shows of Vegetables and flowers, distribution of seeds, &c. ..	192 2 0	
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STATIONERY.

„ Stationery, for Office books &c, for the use of the Office, ..	71 6 0	
„ Brown packing paper for packing seeds, ..	65 0 0	
	<u>137 6 0</u>	

Carried over, Co.'s Rs., 30,629 9 0

Statement.

FRIEGHT.		
Brought forward, Co's Rs.		20,629 9 0
By Freight on boxes of seeds, books &c. sent and received for America and England,	... ..	699 15 9
LOAN.		
„ Bank of Bengal in part repayment of a loan of (Rs. 2000) with interest for 6 months,	... ..	554 7 1
FURNITURE.		
„ Sundry Articles of Furniture,	... ..	480 9 0
PLOUGH.		
„ Messrs Lackersteen and Co. for a plough,	... ..	25 0 0
METCALFE HALL.		
„ Society's proportion of Assessment on the Metcalfe Hall from October 1861 to September 1862,	... ..	127 8 0
„ Ditto of Ditto for lighting tax from Oct 1861 to Sept. 1862,	... ..	42 0 0
„ Moderosoodun Roy for Society's proportion for inspecting and reporting on the Metcalfe Hall building from April 1861 to 31st December 1861,	... ..	15 0 0
„ Messrs Barn and Co. half the Society's proportion for General repairs of the Metcalfe Hall Building in part,	... ..	650 0 0
		864 8 0
LISEED		
„ Superintendent Royal Botanic Garden, Saharnunpore, for Linseed for A. and H. Society Madras.	... ..	18 11
PETTY CHARGES.		
By Sundry charges, including postage on letters &c. sent and received and for copies of the Journal,	... ..	631 14 0
„ Extra writer and packermen for sub-dividing and writing on seed papers and for soldering tin boxes and lining wooden boxes with tin, sent to non-resident Members, and for other petty charges,	... ..	260 12 0
„ Expenses incurred in putting up a fence round a portion of the Auckland Circus &c. superintending the erection of tents for flower and Vegetable shows of the season,	... ..	223 14 6
„ Presents to constables for attending at Horticultural and Floricultural Exhibition during the year,	... ..	68 0 0
„ Secretary Bank of Bengal for Commission for drawing Interest,	... ..	1 12 2
„ Government for Income Tax on interest on Government Securities,	... ..	10 2 1/2
„ Secretary Bank of Bengal for Stamped notes for Loan Rs. 1500	... ..	8 0 0
„ Messrs. Thacker Spink & Co. refund for fruit grafts &c. on account Dr. B. Hecke,	... ..	16 9 0
„ Capt. J. G. Hill on account of the Estate of the late Major Ivie Campbell refund of subscription paid in advance,	... ..	19 0 0
		1290 0 9
Total Disbursements Rs.	... ..	31,602 12 1
„ Balance in the Bank of Bengal on 31st December 1862,	... ..	120 4 0
„ Ditto in the hands of the Secretary on Ditto,	51 3 2
		391 7 2
Grand Total Co's. Rs.	...	31,924 4 4

MEMORANDUM.

Statement.

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Disbursements.		Receipts.	
To amount of disbursements during the year 1882,		By amount of receipts during the year 1882 at	
as per statement	31,692 13 1	per statement,	21,416 4 1
" Balance in the Bank of Bengal on 31st Decem-		" Balance in the Bank of Bengal on 31st De-	
ber 1882,	260 4 0	cember 1881,	499 15 0
" Ditto in the hands of the Secretary on ditto,	51 2 3	" Ditto in the hands of the Secretary on ditto,	38 1 2
	<u>321 7 3</u>		<u>518 0 3</u>
Total Rupees, 21,924 4 4		Total Rupees, 21,924 4 4	
Liabilities.		Dependences.	
Amount due by the Society for American seeds		Amount invested in the Government Securities	
of 1861-62,	8,700 0 0	lodged in the Bank of Bengal,	30,323 5 4
Ditto for Agricultural seeds of 1862,	1,250 0 0	Ditto of subscriptions in arrears,	12,888 1 0
Ditto for English Vegetable seeds of 1868,	2,085 0 0	Ditto outstandings for seed-grafts, copies of	
Ditto for English sower seeds of 1861-62	4,760 0 0	Journal &c., &c.,	1,950 10 3
Bank of Bengal a Loan,	1,900 0 0		<u>14,816 11 3</u>
	<u>18,535 0 0</u>		

LIST OF MEMBERS

OF THE

Agricultural & Horticultural Society

OF

I N D I A.

DECEMBER 31st, 1862.

ALPHABETICALLY ARRANGED

AND

DISTINGUISHING THE YEAR OF ADMISSION.

OFFICE-BEARERS.

President:

ARTHUR GROTE ESQ.

Vice-Presidents:

W. HAWORTH, ESQ.
BABOO RAMGOPAUL
GHOSE,

S. DOUGLAS, ESQ.
BABOO GOBIND GHUNDER
SEN.

Secretary and Treasurer:

A. H. BLECHYNDEN, ESQ.

Acting Secretary and Treasurer.

S. H. ROBINSON ESQ.

Members of Council:

DR. J. B. BARRY.
RAJAH PROTAP CHUNDER SING BAHADOOR.
W. G. ROSE, ESQ.
BABOO PEARY CHAND MITTRA.
DR. T. ANDERSON.
J. S. ELLIOT, ESQ.
J. AGABEG, ESQ.
S. P. GRIFFITHS, ESQ.
T. H. MOSLEY, ESQ.
CAPT. W. N. LEES, L L. D.

Patron :

THE RIGHT HONORABLE EARL ELGIN, G. C. B.
VICEROY AND GOVERNOR-GENERAL OF INDIA, ETC., ETC., ETC.,

List of Members.

* This Mark denotes Members who have compounded for their Annual Subscriptions.

† This Mark denotes Members who are absent from India, and therefore Non-contributors.

‡ This Mark denotes Members who, though absent, are desirous of continuing their Subscriptions.

HONORARY MEMBERS.

The Right Honorable Sir Edward Ryan, A. M., F. A. S., London,	1829	1841
Colonel John Colvin, C. B., London,		1830
J. Mackay, Esq.,		
Don Ramon de la Sagra, Island of Cuba,		
Dr. Justus. Leibig, Professor of Chemistry in the University of Giessen,		1843
Major General Francis Jenkins, Gowhatty (Assam) .	1828	1852
The Right Honorable Sir Lawrence Peel, London, ..	1842	1856
R. Fortune, Esq., China,		1856
Sir Arthur Buller,	1849	1859

CORRESPONDING MEMBERS.

D. J. Macgowan, Esq., M. D., Ningpo,	1851
Dr. J. V. Thompson, Sydney,	1840
Dr. R. Riddell, London,	1853
Mons. Natalis Bandot, Paris,	1858
Capt. Thos. Hutton, F. G. S. Mussorrie,	1861

ASSOCIATE MEMBERS.

Mr. R. Scott, Head-Gardener, Royal Botanic Garden, Calcutta,	1851
Capt. E. P. Nisbet, London,	1842

ORDINARY MEMBERS.

Admitted.

ANNOTT, Horace, Esq., Burrumaseah Factory, Rampore Baulah,	1858
Abbott, Col. S. A., Lucknow,	1860
Abdool Gunny, Kajee, Zemindar, Dacca,	1860
Ackland, C. J., Esq., Merchant Calcutta,	1855
Ackland, George, Esq., Merchant, Calcutta,	1853
Agabeg, J. Esq., Merchant, Calcutta,	1854
Agabeg, M. Esq., Merchant, Rangoon,	1858
Agabeg, A. L. Esq., Calcutta,	1860
Ahmuty, R. Esq., Supt., Govt. Estates, Mymensing,	1858
Ainalie,† W. Esq., Civil service,	1847
Alexander,† Henry, Esq., Civil service,	1846
Alexander,† H. A. R., Esq., Civil service,	1855
Alexander, H. W. Esq., Civil service Patna,	1861
Alexander, T. J. Esq., Civil service, Monghyr,	1862
Allardice,† Geo., Esq.,	1854
Allan, Dr. James,	1858
Allen, J. H. Esq., Merchant, Calcutta,	1850
Allen,† W. J., Esq., Civil service,	1850
Allen. Capt. A., (late, 55th N. I.,) Roorkee,	1860
Allen, Capt. A. S. Cantonment Joint Magistrate, Cawnpore,	1861
Allowallea,* Rajah of Kapoorthullea, Jullunder,	1853
Anderson, Andrew, Esq., Sub-Deputy Opium Agent. Futtehpore,	1861
Anderson,† Esq., Merchant, Calcutta,	1854
Anderson, Thomas, Esq., M. D. F. L. S., Offg. Superintendent, Botanic Garden, Calcutta,	1861
Anderson, Major, W. W., (1st Bombay Lancers) Supdt. H. H., the Guicowar's Contingent of Horse, Rajkote, Kattywar,	1859
Anderson, William, Esq., Merchant, Calcutta,	1860
Andrew, H. Esq., Civil Engineer, Dinapore,	1860
Angelo, Elliot, Esq., Merchant, Calcutta,	1859
Anley, Arthur Esq., Beshpore, Kishnaghur,	1861
Annesley, Capt. R. M. S., (Meywar Bheel Corps,) Karwarah, Meywar,	1858
Apcar,† Thomas, Esq., Merchant,	1861
Apurva Krishna Bahadoor Calcutta,	1862
Armstrong, C. M., Esq., Opium Dept., Gya,	1858
Armstrong, J. W. Esq., Supt. Engineer Cuttack,	1862
Atherton,† H. Esq., Dhurmsala,	1845
Atkinson, T. G. Esq., Secy. Beerbhoom Coal Compny. Calcutta,	1862
Anley, George Esq., Civil Engineer, Cuttack,	1861
Aubert Henry A. Esq., Indigo-planter, Benares,	1862
Augier, P. Esq., Calcutta Mint,	1858
Auld,† S. J., Esq.,	1846

BADGLEY, Lieut. W. F., 30th Native Infy. Moradabad, ..	1860
Bainbridge Herbert Esq., Tea-planter, Assam, ..	1862
Baird, Major, A. F. Executive Engineer, Hazareebaugh, ..	1861
Balfour, G. G., Esq., Civil service, Chittagong, ..	1844
Balfour, Lewis, Esq., Merchant, Calcutta, ..	1842
Barnes, C. H., Esq., Colgong, ..	1858
Barton, G. W. Esq., Indigo-planter, Shahpore Factory, Arrah, ..	1862
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Travers, Lt. Col. J., Sehore, ..	1850
Trevor, Edward Taylor, Esq., Civil service, Bauleah ..	1844
Tripp, H. D., Esq., Indigo-plauter, Salgamuden, Commer-Colly, ..	1852
Tronson, Capt. T. H., Supt. P. and O., Company, Garden Reach, ..	1862
Trotter, T. C., Esq., Civil service, Patna, ..	1856
Wacker,† Henry Carre, Esq., Civil service, ..	1837

Tucker,† W. T., Esq., Civil service,	1855
Tucker, W. H., Esq., Civil service, Allahabad,	1861
Tulloh, Capt. R. H., Executive Engineer, Azimghur,	1860
Tulloh, Capt. J. S., Artillery, Jullundur,	1861
Turnbull, C. S., Esq., Silk Manufacturer, Ghuttal,	1859
Turnbull, Lieut.-Col. A. D., (Bengal Engineers,) Supdt. Genl. of Irrigation, N. W. P., Roorkee,	1851
Turner,*† Thos. Jacob, Esq., Civil Service,	1836
Twynam, Lt. E. J. L., Executive Officer, Arracan, Akyab, ..	1856
VARDEN, A. M., Esq. Merchant, Calcutta,	1851
Vivian, G. W. Esq., Civil Engineer Morshedabad	1862
Vertue,† Lieut. J. S., (Madras Engineers,)	1859
Vetch,† Col. H., Assam,	1842
Vincent, Capt. F. F., 16th Regt. N. I. Shangai, China ..	1859
Vincent, F. L., Esq, Civil Engineer, Monghyr,	1859
Vizianagram, His Highness the Rajah of,	1847
Vonfügger, Max, Esq., Tea-planter Kollacherra Cachar, ..	1862
Vos,† J. M., Esq, Assessor of House Tax,	1847
WAGENTREIBER, W., Esq., Tea-planter, Debroghur,	1857
Walker, Alexander, Esq., Merchant,	1855
Walker, G. A., Esq., Tea-planter, Chineeoorree Tea Gardens, Cachar,	1861
Wallis,† J. J., Esq., Merchant,	1856
Walters,*† Henry, Esq,	1836
Ward, J. D., Esq., Civil service, Chittagong,	1857
Warner, J. E., Esq, Indigo-planter, Kishnaghur,	1856
Warwick,† B. Esq., Merchant,	1849
Waterfield, E., Esq, Civil service, Budaon,	1846
Watson,† Hartly, Esq., C. E.,	1858
Watson,† John, Esq, Merchant,	1852
Wauchope, S., Esq., Civil service, Calcutta,	1848
Wavell,† Wm. Esq., Civil service,	1859
Weld, Capt. George, Chunar,	1861
Wemyss, Sir John, Bart, Berhampore,	1859
Weskins, Charles, Esq., Merchant, Calcutta,	1854
Whampoa, Mr., Merchant, Singapore,	1850
Whinfield, E. H., Esq., Civil service, Gya,	1860
White, Capt. M. J. District Supt., of Police Bijnore, Rohil- cund,	1862
Whitney† W. M., Esq., Merchant,	1860
Wienholt, W., Esq., Merchant Calcutta,	1848
Weinholt, John Esq, Merchant, Calcutta,	1859
Wight,*† Robert, Esq., M. D.,	1836
Wilcox Lt. E. R. C., Cantonment Magistrate, Lucknow, ..	1861
Wilkinson, Capt. 7th Hussars, Umballa,	1862
Williams Capt. E. C. S. Bengal Engineers, Roorkee, ..	1861

Williams, Fleetwood, Esq., Civil service, Meerut,	1840
Williamson, Lieut James, Commandant 18th Regt. Punjab, N. I., Moradabad,	1849
Williamson, Geo, Esq., Cumamara Tea Factory, Jorehaut, .. Assam,	1858
Williamson, George, Esq., Junior, Jorehaut, Upper Assam,	1860
Williams, J. Esq., Meeywar Agency, Agra,	1859
Willis, Joseph, Esq., Merchant, Calcutta,	1827
Willock, † H. D., Esq., Civil service,	1855
Wilmot, C. W., Esq., Assist. Commissioner, Sonthal Pur- gunnahs, Pakour <i>vid</i> Jungypore,	1859
Wilson, A., G., Esq., Deputy-Magistrate, Burhee, . . .	1847
Wilson, Thomas, Esq., Deputy Opium Agent, Ghazeepore,	1848
Wilson, Charles Esq., Civil Surgeon, Roorkee, .. .	1860
Wilson, Major, H. M., Comd- Hill Rangers, Bhaugulpore,	1860
Wilson, J. F. E., Esq., District Engineer, E. I., Railway, Soorool,	1860
Wilsone, C. M. Esq., Munglepore,	1853
Wingrove, † E., Esq., Merchant,	1846
Wingrove, G. W. Esq., Merchant,	
Wingfield, † C. J., Esq., Civil service,	1855
Wintle, Charles F., Esq., Sub-Deputy Opium Agent, Futteh- pore,	1859
Wintle, Capt. E. H. C., late 61st Regiment N. I., Dum, Dum,	1860
Withall, Surgeon Major R. 25th Brigade Royal Artillery Dehra Dhoon,	1862
Wood, C. B. Esq., Merchant, Mirzapore,	1856
Wood, J. N. T., Esq., Merchant, Calcutta,	1854
Woodcock Capt. (Bombay Army,) District Supt. of Oude Police, Fyzabad,	1860
Worsley, J. T., Esq., Deputy-Magistrate, Nowada, .. .	1859
Wray, † G. O., Esq.,	1857
Wright, H., Esq., Shahpore. Punjab,	1854
Wroughton, Capt. H. R. Sub-Asst. Commissary General, Fyzabad.	1860
Wyatt, G. N., Esq., Indigo-planter, Peeprah, Mootehary, ..	1861
Wylie, Macleod, Esq., Secy. to the Legislative Council, Calcutta,	1844
Young, William Gordon Esq., Civil service Chittagong, . .	1862

JOURNAL
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OF
INDIA.

Hand-book for the Cultivation and Manufacture of Tea in Java.
By J. J. L. L. JACOBSON, *Inspector of the Tea Cultivation in Java.*

(Translated from the Dutch.)

[In the earlier Numbers of this Journal will be found a translation of a portion of the above Work, as far as paragraph 317, by the late Mr. R. W. G. Frith. The concluding portion having been recently translated by Mr. H. Reinhold, and kindly placed by him at the disposal of the Society, the Committee of Papers, in communication with the Tea Committee, deem it desirable, in printing the latter part, to reproduce the first part also, with the view of enabling Members, and others, interested in this annually increasing important staple of Indian growth and manufacture, to have the paper before them, in a complete form, in the present Number. This is the more necessary as several of the earlier Numbers of the Journal are out of print.]

PREFACE.

THE cultivation of tea, when carried on as it should be, is one of the richest branches of agriculture, and it has a very favourable influence on industry, and offers to commerce incalculably great advantages both mediate and immediate.

In China almost all tea-planters and tea-dealers are rich and influential people, and the celebrity of Canton as a commercial city, and the inestimable riches which pour into her provinces, already

Now for more than 200 years, are alone to be attributed to that product. The same can be of equal consequence to Java and the Netherlands. Such was the conviction on my mind, when I beheld the first tea plants which had arrived in Java.

In the month of July 1827, 500 tea plants were brought from Japan to Buitenzorg, and there planted in the Government garden. My arrival here from Holland took place on 2nd September 1827. The commission with which I was invested by the Dutch Trading Company, carried me to Canton; before my departure I had the honor of an invitation from His Excellency the Commissary General Viscount Du Bus de Gisignies, to collect in China all information regarding the culture and manufacture of tea.

Three circumstances worked favorably, so as to prevent my investigation concerning that, being brought to a fruitless end; the first, was the instructions in the tea line, which, since the year 1814, I had obtained from my father himself, one of the best judges of tea;—his benevolence and father-like patience were inexhaustible;—a mass of rules for ascertaining the good or bad qualities of tea, and which he must have brought together with the most persevering assiduity, proved to me of the utmost importance, when I subsequently turned my thoughts more seriously to the tea plant: these lessons which I obtained from that worthy parent, I may most assuredly lay down as the foundation of that sound knowledge that I hereafter gained regarding the cultivation and manufacture of tea. The next circumstance, was the connection, into which I was led from my calling, with the first and most respectable Chinese tea merchants in Canton. Nominated as an experienced tea taster to the Dutch Trading Company, I had, by the necessary orders then issued, (instructions dated 28th April 1827 No.) “that without my interference or knowledge, no tea should be bought, nor even the prices of the same fixed;” a degree of confidence imposed upon me by that esteemed body, which gave me the opportunity of gaining the object I had in view. Every word uttered by the hong merchants and other tea-dealers, which in any degree tended to give an insight into the qualities of the product, was most eagerly taken advantage of by me; by them I was introduced into most of the tea establishments at Honan, and having once become acquainted with

the people, I soon found my way to the manufactories, and, what was more desirable to the tea plantations of Tingsoea, situated a little distance off. The knowledge I thus gained in China, I endeavored, in process of time, to bring into practice in Java, and what I observed myself still deficient in Java, I again searched up in China. This lasted for a period of six years; and I travelled backwards and forwards from Java to China for this very purpose. Had it not been for the connection in which I was with the Dutch Trading Company, most probably I never should have attained the object I had in view. Lastly, the third circumstance, which came most powerfully to my aid, was the unceasing kind and benevolent support and treatment that I had the honor to experience from His Excellency the Commissary General, Viscount Du Bus de Gisignies; this gave me the opportunity annually of experimenting upon the before-mentioned 500 tea plants from Java, from month to month, placing them out in various directions in the Preanger Government gardens, and in this manner making observations upon them every year. I shall always bring to my recollection the name of this nobleman with the highest esteem and the most sincere gratitude; by his assistance I was enabled to bear up against the difficulties and oppositions, wherewith I so immediately had to contend, and already in 1829 to produce both green and black tea,—yes, and even Souchong and Pecoq, (See General History of Agriculture, published in Batavia in 1829.) By his Excellency's recommendation I experienced the same aid from the Governor General J. Van Den Bosch, who has been allowed the good fortune, like the first, to introduce the cultivation of tea in Java; while I in the meantime was honored with considerable personal attentions from his respected successors. Viscount Du Bus de Gisignies was likewise the cause of the few tea plants which originally existed in Java having been brought to good account. Thus, three incidents worked together, which well considered, served to unite themselves in such a manner as to establish the happy result, which the tea cultivation of Java has already brought about, and which will ere long develope itself still more.

In the month of February 1839, I had already brought round a number of genuine Fokeen tea plants from China into Java; they

were planted at Tjisroepen, are still alive, and are, in consequence of the abundance of seed they have produced, the origin of hundreds of thousands of the choicest tea plants. Although it was asserted on their arrival, that they and the Japan tea plants were one and the same kind, it subsequently appeared very evident when coming up, that the China plant in every respect deserved the preference. It was speedily ascertained that the search for Chinese in Java, who understood both the culture and manufacture of tea was fruitless; here and there a man was to be found who could pluck, roll, and dry the leaves, but such produce never paid; and it is worthy of remark, that now, no more than then, notwithstanding every encouragement, no Chinese who had come direct from China, were to be found on Java, who knew how to make merchantable tea, or rather tea merchantable, which is a different thing. The only cause probably that can be assigned for it is, that proper and qualified tea makers have seldom or ever from the first betaken themselves out of the country. For these reasons I was instructed by the Government, to endeavor to bring with me seeds, planters, manufacturers, and chest makers from China. It was, indeed, a difficult undertaking, of which it will be acknowledged to have been almost impracticable, particularly by those acquainted with Canton and its thousands of spies. In the meantime, I had the good fortune in two years to transport hundreds of seeds and plants, and eventually in January 1832, all the workmen that were required, and hundreds of thousands of tea plants to Wanajassa, (Krawang Residency.) This expedition was repeated (in consequence of a particular circumstance,*) with such fortunate result, that I

* From the beginning of February 1832, until my return again to China, I was, by being relieved at Buitenzorg, either in the Preanger Regency or at Batavia; I was not therefore present at the insurrection at Krawang, whereof Mr. R. J. L. Bussendragers makes mention in his physical and geographical description of the island of Java, published at Groningen in 1841, page 86; nevertheless, it is evidently from official documents in my possession, an historical error, that, that occurrence was caused by tea planters who had come from China. The Chinese of Tjilangkap, the place where the disturbance was created, were of the lowest class, and amongst them there were no tea-planters. My Chinamen lived at some distance off over the Routjadara mountain,

arrived again in February 1833, with a set of workmen, and with millions of seeds from China, at Bundong (Residency Preanger Government) where they were placed under my immediate control.

* I shall not expatiate on the dangers to which I was obliged to expose myself during a period of six years, and more particularly during these two last expeditions, but I shall simply state, that according to two letters which I received one after the other, on the 29th December 1832, from Mr. M. J. Senn Van Basel, Dutch Consul at Canton, when on board of the "*Jeannete Phillippine*," my interpreter and *factotum*, by name Achung was seized by the mandarins and taken prisoner, and they expected to find me, my Chinamen, and the tea seeds in his boat, and I was advised to set sail immediately; (Achung was subsequently ransomed for a sum of 500 Spanish dollars through the influence of the said Mr. Van Basel.) Notwithstanding the dangers of every kind, the object was gained, and experience has shown, that the greater part of the seeds that were imported, lived, and the workmen, each in his own department, became skilled, and thereby a healthy state of affairs was speedily established.

Nevertheless, for a short time the tea culture underwent the fate of all new undertakings; and so precarious that the most resolute perseverance was necessary to bring it to its present state. But now it has reached a period of fair expectations, for under the administration of the present Governor General, and under the direction of the present Superintendent of Agriculture, the beneficial results of tea cultivation will, ere long, show themselves. It is not from mere supposition that I thus speak, but from an inward conviction of the good effects which the united exertion, coupled with the knowledge and skill, with which these statesmen labor, must bring about.

I trust, that the authorization granted to me by the Supreme

at Wanaijassa, and were, according to the testimony of the universally esteemed member of Council and director of the cultures, the late Mr. J. J. Van Sevenhaven, quiet, industrious and respectable people, and whose appearance was much more favourable than any he had ever previously met with.

* Government, by resolution dated 30th December 1842, No. 12, to print the Hand-book for the cultivation and manufacture of tea, and which my worthy readers here have presented to them, may contribute something to these results. As early as 1836, the want of means of instruction and guidance was greatly felt, though the scheme was yet so novel, that people might very justly conclude that theoretical accounts never would be understood by any one. Government, in consequence, supplied me by degrees with native workmen who were relieved, also the sons of Javanese Chiefs, further, with twelve Superintendents, and lastly, a considerable number of Chinese, making a total of upwards of 200* men, that they might be instructed practically in the tea plantations and manufactories; and they all returned with sufficient knowledge, and accompanied with the necessary notes compiled by themselves, and afterwards corrected by myself, of all they had heard and seen. Very shortly, in consequence of this, and as if at the same moment, tea is produced in all the residencies.

This had also a beneficial result at first, but about two years after, people began to think, that it was time more should be done; the necessity for the existence of clear and explanatory works, which might at any time be consulted, was every where apparent. In July 1839, consequently, I proposed to effect this, and in February 1841, I became duly authorized; in September following, I delivered this Hand-book in, and now I have the good fortune to present the same to the public.

It contains the results of my researches after the knowledge of the culture and manufacture of tea, which I carried on for six successive

* I believe that taking all these matters into consideration it will appear evident how that I have from the very beginning employed every means in my power, which the circumstances permitted, to spread the knowledge of the culture and manufacture of tea in every direction: it would indeed have been folly to have wished to withhold that science for one's own benefit, and to introduce a branch of agriculture for which hundreds of people are required who must possess the same knowledge. The publication of this Hand-book then, will probably do more, than what Mr. Prætorius in his "Thoughts upon the improvements necessary upon the times, in the system of cultivation in Java" page 25, calls nothing more than superficial.

years in China,* and which, in Java, I brought into practice uninterruptedly for fifteen years; mostly with the assistance of my Chinamen, and attended always with comparisons and investigations. Experience has thus taught us, that the tea shrub thrives all over Java, and that in general, the husbandry and industry which it promotes, is capable of no great improvement. At the same time it is to be expected, that, on account of the changes of hills and plains, and the difference arising therefrom in the temperature and lands, satisfactory deviations will naturally find place here and there, from the rule before laid down in this Hand-book. A knowledge thereof cannot in the mean time be obtained, without some principle being shown; that principle, that general rule, I here present to my readers, while they can apply the same according to the state of affairs.

I have considered myself somewhat bound to expatiate upon my labors, until such time as I had gained the knowledge, which I hereby communicate to my readers, so that people might be convinced, that no imaginary theories, but the result of prolonged researches were brought forward, and which time, has in a great measure

* With reference to that, it will be proper to give an instance; I had, namely, many accounts, which were all unanimous in informing me that the tea plant blossomed in the month of October, (§ 89); this appeared to me exceedingly strange. When however, on my arrival at *Honam*, in the months of July and August, I became better acquainted, (§ 191); people promised in the course of a short time to take me to the tea plantations. This took place in the month of October, and assuredly I found the plants in blossom. On my return again, it occurred to me that I should have been there even earlier, as I visited both tea plantations and tea establishments, and was then at a place called *Tniy-sac-a*, (§ 220); I went accordingly in November thither, and witnessed the plants positively in full blossom.

In the meanwhile I should be inclined to hold, that such is to be attributed to the warm aspect of the country, as also to the mild and gentle showers which fell at that time in the months of October and November; but that in the hilly parts, the time of flowering of the plant takes place earlier, provided always, on the other hand, that no other circumstance interfered with its regularity. I never could procure seeds either from *Fokuen* or from *Feitchan* earlier than the month of December, because there, they are collected in October, a year after the blossoming of the plant.

shown, and eventually will exhibit at once in the clear light of day.*

As far as the plan of the work is concerned, I trust I may be here allowed to mention, that I have fancied to myself two different classes of readers. In the first place, such, as are experienced in agriculture and the *manufacture* in a general way, only desire, an insight into the culture and manufacture of tea leaf in a few words; for them probably, the summary of which the first volume is composed, and which by the desire subsequently made known to me of the Government, I had especially prepared, might be sufficient. But I also picture to myself, readers, who are novices in the science of agriculture; beginners, who must learn from the very commencement; young men of from eighteen to twenty years of age, just commencing life: experience, has made me acquainted with the errors they are most liable to, and these I have by sundry explanations and evidences, laid down as a rule in the two following volumes, which are more especially designed for them. From that to a prolixity descending into the minutest details, and the repeating and describing of particulars which are there met with, and such as people are generally acquainted with: † from thence I shall perhaps have to

* I must tender my best thanks to a friend for the gratification which he has afforded to me, just about this time, (July 1843) by the presentation of an extract treating upon the cultivation of tea in China, from a voyage round the world, in 1835, 1836, and 1837, published by Rusehemberger, an American physician. In some respects, a few remarks require to be made upon this extract, for instance, regarding the prices of tea; as the thail being taken at 62½ cents., while the Sp. M. being reckoned at f. 2.60, brings f. 3.61; also as regards Souchin, and Schin, the information is devoid of truth. Though this may be ascribed to the difficulty of gaining information from the Chinese, (§ 481;) but whatever was to be *seen*, has not escaped the observation of the worthy writer, and such agrees in the main view, with the information supplied by myself to the Government, and with the system carried out in Java. This is particularly remarkable in the pruning: the height of the plants; the annual repetition of the picking; and that the teas after having undergone the first process of the manufacturing, are made ready for the market, in other establishments and by other workmen. The like plan exists in that particular establishment, which is in Java.

† For instance the business of putting up *Galangs*, &c. over 240 Bouws,(a) within thirty-five days, with 360 hands amongst whom scarcely 120 are able

(a) 5 square rods.
500 = 1 bouw.

1 Square rod = 144 square feet.
1 Bouw = 72,500 square feet.

console myself with the imputation of rather too great a degree of eagerness (otherwise a great fault) in the interest of the undertaking, and the object I have in view.

No one can entertain a stronger feeling than I do, that in this present work of mine, as in all human undertakings defects exist, and of the difficulty, which, in spite of every means used, and continually repeated, still here and there explanations will be necessary. For the welfare, both of the undertaking and the country itself, I intreat all competent judges, whenever this may be the case, to bring the same to my notice. The division in paragraphs which I have followed will thereby afford great facilities. The esteemed editorship of the Magazine of Netherlands India, which has already contributed so extensively towards the spread of the arts and sciences, will no doubt be pleased to set aside a few of its pages for the like purpose.

bodied ones (§ 163 to 167), is considered impracticable, although my official statements, regarding the result of such labors, (accompanied by the favorable accounts from the residents and native overseers of the same) were not susceptible of the slightest contradiction; then it was that people followed the example, and the good results were not far distant; at another time people were afraid, that as the expression to lay the ground out, is "*lay sawas out*" (§ 69) no native would undertake to do this under one Sp. M. the *kotak*, and that this mode of working, although it was not accompanied with much trouble, but beyond that would make the cutting out much more expensive than f. 25, the 500 square rods; (§ 60) there again my official reports bear testimony against this apprehension: thus the plan was tried; when immediately it was evident, that the work fell light and was speedily executed; for the division of labor (§ 70) was good, and what is more, the descents or steps were not made deeper than half to one foot; (§ 73) the result was in consequence that people were well satisfied with paying f. 25- per bouw; the more, as it did not any longer appear to be a secret, that notwithstanding one Sp. M. was paid for cutting out one *kotak sawa*, still for the bouw of 500 square rods, even when *kotaks* of two feet descent were made, often came to only f. 17 to f. 18, on that account one *kotak* is usually seventy-five rods square, to wit, fifteen rods in length, and five in breadth. As people did not hinder the progress through such doubts, it appeared to me that a prolixity was necessary.

A glossary of the Malay words used in this Hand-book.

Abjir,	a land-mark.
Allang-allang,	high grass.
Atap,	a thatch (of long grass.)
Babat,	to dig, (dig grass out.)
Bamboe,	bamboo.
Billiek,	bamboo mats.
Desaa,	a village.
Ajongdang,	a covered hand basket.
Gaga,	land just dug, refreshed, and where rice would be planted.
Gallang,	a fence.
Gandaresa,	a crop of plants.
Glaegoe,	a tree from which Javanese or Saaij paper is made.
Hipock,	seedling plants.
Kotak,	a square platform, with raised sides and a step; and whose height is equal with the slope of the ground.
Krandjang	a basket.
Kwalie	an iron pan.
Mandoor,	a native overseer.
Pager,	a hedge, a wooden partition.
Parang,	a weeding instrument, a hoe.
Patjol,	preparation for digging.
Pettak,	a square marked out with beacons and with fences.
Pojjong, (<i>Chinese</i>),	a drying basket.
Sawa,	a watered rice field.
Slokkan,	a water course.
Tampier,	a flat bamboo fan.
Tipar,	a watered rice field.
Tjadas (or wadas)	a particular kind of stone.

INTRODUCTION.

On the Culture of the Tea plant in general.

1. Japan produces little or no good tea. China supplies the whole world with tea. Java enjoys at present that privilege.

2. In 1827, the first tea plants imported were received in Java from Japan, and in the same year the necessary enquiries were being made in China regarding it. In 1829, the first tea plants were imported into Java from China. The Chinese tea was better than that from Japan, a considerable transport of tea seed, plants, likewise manufacturers, and work people were in consequence sent for into Java, and received from thence.

3. The Japan tea plant throws out lateral shoots, and the China plant shoots more vertically; the latter named tea is more easily manufactured than that from Japan.

4. The tea plant does not *degenerate* in Java; nevertheless change of land takes place when the plants are being put out.

5. Yet a change in the plant takes place, by changing the seeds in different lands. A difference in the color of the fruit becomes also perceptible.

6. Black and green tea are made from all tea plants; partly owing to the nature of the soil, but more especially to the mode of manufacturing it. Plants with fine looking light-brown colored branches, and the stalks of the leaves of a dark red color, produce the best black tea.

7. There is one kind possessing all these indications, which indeed in the hands of a good manufacturer produces finer black than green tea; the leaves are smaller, and the young branches or shoots in greater number than is met with in the common plant. There is another somewhat similar but it is not fit for cultivation, though easily distinguished.

8. There are two other kinds with small, hard, faded-like looking leaves, these must be destroyed.

9. The good quality of tea depends in a great measure upon the soil and the atmosphere, but likewise also to a considerable extent upon the manufacturer: the best tea comes from the high and cool districts, but nevertheless, good tea can be made from low and confined warm districts by such as are well skilled in its manufacture.

10. The quality, however, is very often dependent upon the nature of the country and the situation of the ground; a low situated plantation, open from north to south, surrounded by a semi-circular range of hills, also produces good tea.

11. The tea plant thrives throughout the whole of Java, even in the vicinity of the sea-shore, which circumstance is probably to be attributed to the virtuous properties of the soil. The tea plant from gardens along the shore is not so productive as those from higher localities.

12. 13. 14. The tea plant requires but one mode of treatment. The cultivation of tea is profitable to the planter and of the highest importance to commerce.

CHAPTER I.

Regarding the Atmosphere.

15. Tea thrives best in mild, temperate or cool climates : such are to be found in the hills. At an elevation of from 3,500 to 4,000 feet above the level of the sea, where the thermometer (Fahr.) before the rising of the sun would be about 58°, and at 2 P. M. at about 74°. The tea plant is very fragrant. From lower elevations it is less fragrant.

16. Fine souchong, fine pekoe, and fine green tea, are obtained from cool localities, the sun being in such places less powerful : lower lands on the contrary produce good kinds of Congou, Kem-poy or green tea.

17. At an elevation of twenty feet above the level of the sea, and at a distance from it of about five hours' journey, it is worth while planting tea ; provided always, that it can be watered. Tea grown, however, in such a situation, is of a light quality.

18. The tea plant enjoys itself to a great degree in misty and dewy climates, it accordingly does best in the hills, but it can also be cultivated to advantage in the lower lands where dew falls.

19. It is even desirable to plant as high as 5,000 feet above the level of the sea ; but such as are not able to plant except in the lower land, can do so without much risk.

20. Tea must never be planted in districts which are constantly exposed to incessant drought, caused more by sunshine than heavy winds. Open plains, exposed to strong winds, and where little or no dew falls, and which are constantly sultry, are never good for the tea plant.

21. Tea may with safety be planted only in places which are subject to temporary heavy winds. The tea plant delights in cool and airy places ; whirlwinds occurring in tea plantations are certainly destructive, but they seldom cause any serious damage.

CHAPTER II.

On the Nature of the Soil.

22. The soil must be, in every respect, of a temperate nature and well prepared ; the tea plant will then thrive particularly ; it is not

only necessary that the property of the soil be known, but one should become acquainted with the requisites for tea soil in general.

23. Good soil well qualified, or of a mild nature, has half to three-quarters of foot marsh land, under which it is brown, stiff, and clayey (hill) soil. It should not be rich, at the same time not poor, though somewhat sandy, but not more so than just to render the fine clay crumbling; further, it ought to be light and loose when broken up.

24. The soil ought to imbibe moisture but not retain it; it is favorable for the tea plant to get rain often, but not for a continuance; good clay lands hold moisture in some degree before it sinks away; this is greatly beneficial to the tea plant.

25. Very fat rich land, and such as is never worked, and is all marsh land, is not the best for the tea plant; it is to be met with in the high hill country of Java; it is fine ground and soft, for about half to three-quarters of a foot, black and light as garden mould; deeper, dark coffee brown; below two feet, the clear brown and yellowish hill soil appears. The tea then produced is high flavored, but at the same time gross.

26. But in the vicinity of such soils, which are about 3 to 4,000 feet above the level of the sea, lands are to be found which have already been cultivated; or from whose surface the upper earth has been washed away; these are rich but tempered lands, and profitable for tea cultivation.

27. Fine flavored black and green teas are obtained from black soils, because these lie high, and inferior kinds from various soils, these being much lower; the color of the earth scarcely deserves to serve as a rule, in connexion with the situation of the ground and country.

28. Old lava lands are to be recommended; whenever also lava sand is visible, and notwithstanding the ground is already half a foot deep, it is very fine; but there is then in the dry season strict attention necessary, otherwise the roots of the plants become exposed by the sand being blown away.

29. The finest tea is produced on stony, clayey, and such lands as have sand mixed with them. The substances whereof the stones consist must be similar to that of which the earth is composed; the

quantity must be moderate, and size of one foot in diameter; the small stones which are found lying in heaps together in the earth, ought not to be more than about one foot in diameter, otherwise the roots will not be able to spread freely.

30. Lands which are *too* stony are prejudicial to the growth of the tea plant.

31. Stony lands are favorable, as they always contain moisture; on hills where the masses of stone are large, and the fissures filled with good soil, it is advantageous to plant, provided that in such situations, the depth of soil has been ascertained with the aid of a rattan, for each plant, so that the roots may have a free run for at least two to two and a half feet.

32. *Tjadas* (or *Wudas*) lands are never good for tea, not even when the *tjadas* have become so old as to be broken with the fingers; but whenever this, though existing, may have entirely disappeared, then those lands may be planted with safety.

33. Tea planted in *sawas* which are not boggy but in a damp state, is desirable, particularly as regards the green kinds; the *pittaks*, however, must be somewhat sloping, and surrounded by a ditch; when in want of rain, the planter should allow from time to time the hill water-courses to be turned so as to run over the field; but it should not be allowed to remain more than half to one hour.

34. Some lands are better adapted for green teas while others again are for black; this can be ascertained by making both kinds from one and the same sort, and comparing the two together; this occurs in the height of the season; old tea lands are the best; and these being renovated and used, both black and green teas continue to preserve their nature.

35. The tea planter is thus free in the choice of his lands, but he should resolve determinately to produce from his plantation one-third green, and two-thirds black tea; this is to his own, as well as the general interest of others.

36. For both kinds the choice must fall upon the sweet lands; it is not easy to taste the earth itself; but notwithstanding, in first touching it with the tongue, the taste is easily distinguished. In the meantime the roots of the *allang-allang* (high grass) are more sure

distinguishing characters; their taste differs according to the weather and to their age, in such as are of a sweetish nature, sugar cane-like sweetness will always predominate.

37. Before a plantation is laid out, it must be considered at what elevation this is to take place. There can be but more or less 150 days, when the picking goes on; at an elevation of about 5,000 feet three pickings, somewhat lower four, and very low down five pickings take place, but the tea taken at an elevation of 5,000 feet is, when well prepared, worth more than that taken at an elevation of only 2,400 feet; according to the state then of the production generally, we must go to work with reference to the qualities.

CHAPTER III.

On the situation of the districts.

38. On selecting the ground for a plantation, attention must be paid to the situation as well as the extent: it ought to be in circumference about one to two *paal*, * ten or twelve gardens, containing one to one and a half million of tea plants ready to be laid out as occasion may require.

39. Very steep lands are good for planting tea on: gentle slopes however are better.

40. Sometimes in gently sloping lands of one to two hundred *bouws*, heavy steepes and declivities are found, caused by ravines; these must likewise be planted as they are easy of supervision, and the tea from slopes is excellent.

41. Land that is favorably situated, although there may be many slopes, ought never to remain uncultivated; it is profitable, provided the ground is moderately well laid out.

42. Where there are many large trees, the ground is frequently too rich; it is better to select ground in the vicinity; if this cannot be, the trees must be cut down and the ground planted; one tree or so may be allowed to remain as shelter for the work people, but on no account to overshadow the tea plants, for they succeed best in the free and open air.

43. Heavy forest lands can be by degrees commenced upon, by

* This is not a regular Dutch measure, but one in local use.

making first *gagas* ; next into *tipars*, finally into tea gardens. This takes sometime to effect, but the expence is trifling, and the land loses that superfluous richness which is unfavorable for the growth of tea.

44. Stones lying about the surface are allowed to remain for the *gallangs*.

45. Plains of any extent are always more or less hot; they lose earth by rain; such places therefore must be divided into *pittaks* in the same manner as *sawas*.

46. When *sawas* are to be made into tea plantations, the level of the *pittaks* must be gently sloped, that the water may not remain long on them.

47. The situation of each district must be determined for the culture of the tea; but it must be especially ascertained, whether the means there exist, whereby the washing away of the surface earth can be guarded against.

48. The principal requisites are, that the land can be divided into *pittaks* the same as *sawas*, and further that *gallangs* may be made of trees, stones, grasses, weeds, sods of earth, &c.

49. In selecting the localities, attention must be paid to the situation or aspect; the planter should survey the country from all sides, as well with referene to the planting out, as the washing away of the earth; also with reference to the direction in which the work may progress, and above all, whether rice, bamboos, wood for charcoal, planks for making boxes, &c. are procurable.

50. He must, at the same time observe, whether the plantation can be made to lie in a direction north and south, whereabouts the factories may be placed, and if there is water at hand to carry them on.

51. Immediately after the choice of land has been made, a piece of nursery ground should be laid out, containing about forty or fifty *hipocks* of about three-quarters to a foot high, planted four feet square, so that afterwards, as the work is to be divided, this may be available as a stand by when the shrubs begin to bud. At the same time the head *mandoor* must be ready to commence business.

CHAPTER IV.

On the cultivation.

52. An ordinary plantation ought to consist of about one million tea plants, divided into ten principal divisions, called *gardens*; and each garden split into sub-divisions, called *parks*; the shrubs should be planted out about four feet square: and thus there should be for each garden, including the paths, twenty-four *bouws*, and for the ten gardens together, being for the whole plantation, a cultivation of 240 *bouws*.

53. A plantation can be finished in five years, and even in ten, but it is better that it should take place in two; therefore 120 *bouws* should be cultivated in the same time.

54. The cultivating commences by ploughing, so that the ground may be allowed to freshen, and the weeds, together with their roots and seeds, be entirely destroyed.

55. Although the Natives cultivate the lands, the ploughing must take place under an experienced Superintendent.

56. Three ploughings must take place, and between the 3rd ploughing and the time of planting, rain should fall, so that the ground may become somewhat set again, for planting in soft soil is very unprofitable; three months should be allowed to elapse from the 1st to 3rd ploughing, two between the 2nd and 3rd, and one from the 3rd until the plants are put into the ground, making together six months.

57. It is necessary to commence ploughing in the month of May, though somewhat better in April; the earth is at that time still a little moist, easier to break up, and weeds rot quicker: ploughing later, or in the more rainy months, is very injurious; for then the finest particles of earth are apt to be washed away. The ploughing, however, should be so regulated, that the planting can always take place in November.

58. In high rich lands, where within three months the weeds grow up rapidly, both ploughing and planting must all be finished in four months; six months are here taken as a foundation to go upon.

59. It is here understood that a plantation of ten gardens is laid down in two years; that is to say, 120 *bouws* are cultivated. Each

ploughing must be finished in one month, that is, four *bouws* each day. It is also supposed that there is *allang-allang*, which must be first *babat*, and in either case the harrow must be afterwards used. Thus there will be required for four *bouws* each day, as follows :—

1st ploughing 125 men, per *allang-allang*, if there is any.

Ditto ditto 80 ploughs, 80 span (pair) of Buffaloes, and 80 drivers.

2nd ditto 60 ploughs, 60 span Buffaloes and 60 drivers.

3rd ditto 40 „ 40 „ „ and 40 „

Ditto ditto further 125 men to harrow and clean the land. This is taken upon a very liberal scale.

60 Each ploughing must be finished off in four weeks; if it is allowed to last longer, much mischief takes place. If thus the means are wanting for 120 *bouws*, then there must be only forty-eight or seventy-two *bouws*, that is for two or three gardens ploughed up at once.

61. Loose lands require only to be ploughed about ten to twelve inches deep; that which is harder from twelve to fourteen, *allang-allang* lands sometimes still deeper. The earth should not be made fine, but be allowed to remain in small pieces; therefore, when turned up to the depth of ten inches, the plough should go to the depth of five inches the first time, eight inches the second, and the third time to the depth of ten inches.

62. Such as have the opportunity, should give the preference to digging the lands, instead of ploughing them. Sixty-two men can dig one *bouw*, that is eight men to each rod: 248 men are therefore daily required for four *bouws*: the expences are somewhat less, or at most, come equal to that of ploughing.

63. The ground-work of all business, must be task-work, and teaching, the same thus with ploughing. Every day the four *bouws* which are to be ploughed the following day must be marked out by long bamboos, and whenever the ground is not laid out immediately, this must be done by *adjirs* at once on every *bouw*, on account of the direction the furrows must lie in, the drivers must be able to see daily the direction the ploughs must take; and the direction in which the furrows run must be decided upon by guess-work with as much accuracy as possible.

64. In ploughing or *patjollen*,—whether it be in high land—or plain,—the ground must be always turned up obliquely so that the furrows do not run in a direction up and down.

65. The deeper the ploughing goes, the closer the furrows ought to be; for instance, if ten inches deep, they should be twelve or fourteen inches apart, if twelve inches deep, they should be ten or twelve inches apart.

66. When the whole of the ploughing and *patjollen* is finished, the harrow must be used, and the ground made clean and even by the hand or with the rake; the weather at such time must not be too dry nor too wet; for the earth should be allowed to remain *crumbling*. For this purpose October is the best month.

67. Planting without cultivating, is in the end very injurious; if any proof of it is wanted, let certain holes be made one to two feet broad, and one to one and a quarter feet deep; then the earth which was uppermost is kept separate from that which was below, and care is taken, that after planting the upper earth is again placed above; still after a lapse of some years, great loss will be experienced from this practice particularly, in well regulated plantations.

CHAPTER V.

On laying out the ground.

68. Before planting commences, the ground should be laid out, that is, divided into *pittaks*, the same as *sawas* are done.

69. In ordering the men to lay out the *pittaks*, the word “*lay sawas out*” is given, and the work is done with facility and in the proper manner.

70. It is advantageous laying the ground out at once, after the first time it is ploughed; if the *allang-allang* is any impediment to this being affected, then it takes place at the second ploughing. The trouble about marking the furrows is saved, and the marking out by posts is only necessary as regards the four *bouws*. In either case, the ground must be laid out before the third ploughing commences.

71. When laying them out, the pathways and space for the manufactory must be measured out.

72. All the earth which is taken up while forming the *pittaks*, must be allowed to remain; there should be none taken away.

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71. When laying them out, the pathways and space for the manufactory must be measured out.

72. All the earth which is taken up while forming the *pittaks*, must be allowed to remain; there should be none taken away.

73. The slope of the *pittak* must be in proportion to its length, as one to forty-two,—thus three and a half rods in length has but one foot slope; *pittaks* of two or three rods are better than those of four or five rods in length; in level lands they are sometimes six to seven rods in length. Narrow *pittaks* with *steps*, in elevations of half to one foot, are preferable to large *pittaks* with deeper *steps*.

74. Around each *pittak*, fences should be immediately made; when made with clods of earth they require to be half a foot in height; if made of stones, trees, &c., they may be two feet high.

75. Rain is not injurious, particularly when properly carried off by the slope of the *pittaks*. *Slokkans* are therefore unnecessary, except it be to prevent floods: in that case, it is necessary to take notice in which direction the water has run after the first rain, and following this direction, which the natural slope of the hill has pointed out, the courses for carrying off the water should be cut although they may take many turns and windings. In this manner no loss, or tearing away of the earth of any importance, takes place.

76. In works of this nature, order and good management are primary desiderata.

CHAPTER VI.

On the mode of obtaining seed.

77. Immediately after the lands are ready, the planting must commence; the seed should be sent for from other gardens; they ought to have a change of lands, brought from a distance of five or six hours' journey is sufficient. Seeds from rich lands come up very badly in poor lands; any other change is good.

78. Each tea plant produces annually about 250 fruit, which contain about 470 to 480 seeds; many of these are weak, therefore 10 or more seeds, or as many of the fruit must be used as may contain from 14 to 17 seeds, for every plant that is to be planted; 29 to 34 tea plants are to be obtained in this manner from one.

79. Fruit with two or three seeds, and which contain twin or half-seeds, produce also fine plants; but fruits with two or three seeds, containing triplicates and duplicates, are only fit for extracting oil from; these fruits are as large as an apricot, and the color like that of a pomegranate.

80. Tea plants under cultivation bear scarcely any seed, except when they are allowed to shoot out. It is advisable to lay out a separate seed-garden for each plantation, equal as one to forty; thus 25,000 shrubs for ten gardens above the one million. The bastard kinds must be carefully exterminated.

81. About the third, fourth, or fifth years, when the trees do not continue to yield much seed, they should be changed for 25,000 of the one million; the old ones are then cut down to below one and a half foot; they produce tea within six or seven weeks; and the 25,000 from which gatherings took place, shoot forth, and these produce seeds within twelve or fifteen months.

82. Seed-gardens require to be manured; if they become impoverished, they are not manured again, but those are which are to serve as a change.

83. The manuring commences with the third year; after another two years, it is repeated; the seed-garden is divided into four parts; every half year, a quarter (thus 6,250 plants) are manured; this takes place in April and in October, the procuring of the manure and the manuring itself takes place, as partially pointed, the same as is practised in the cultivation of the *Nopals*, (for rearing the cochineal insect.)

84. When manure requires to be brought in, pits for manure must be made from cleft river-stone; for 6,250 plants sixteen pits are necessary, each twelve and a half* feet in length, nine feet broad, seven feet deep, and one and a half feet thick, each will hold 788 cubic feet of manure, that is, each division 394, and thus together for 6,250 plants;—they are left without covering of any kind, or if that be required, they are made of *atap*, four feet in height;—the manure must be allowed to remain in the pits for four months.

85. The cleaving of the river-stones and the mason's work is carried on in a simple though easy manner; the cleaving is done by the aid of fire by whole heaps at a time, and the plastering, with the smooth sides inwards, with wedges and little lime, but over which a covering or plastering of the best cement.

* Rhenish measure.

86. Seeds from yearling plants are good, provided they are large and strong; from two year old plants better, and from older ones the best. Seed-plants require to be planted six or seven feet square; they then grow finer and more beautiful. The seed-garden must be kept very clean, and divided into forty smaller ones; at the time of flowering a good look out must be kept to guard against the attacks of insects.

87. It is difficult to distinguish whether the seed is ripe when in the fruit; to ascertain it, the husk should not be opened, and thereby injured;—the usual appearances, a reddish tinge, with a tint of yellow, and the eye deeply drawn in.

88. Ripe tea seeds are of a blackish-brown color, and assume a perfect black-lead color after being unhusked and exposed to the sun for one day.

89. The time of ripening of the seed is very irregular; the blossoming of the plant generally continues from February until May: in China it begins almost everywhere in October or November, and after a lapse of one year, they become ripe. Three families are generally requisite for the gathering and drying.

90. To acquire experience regarding the ripening of the seeds, all planters ought to make observations and notes, according to existing circumstances.

91. Tea seeds in the husk and heaped up, remain good for ten to fourteen days; to neighbouring districts, they are sent dried in *krandjangs*, provided they can be planted within ten days. If they are not for dispatch, and cannot be planted for three months, they should then be unhusked and dried.

92. In drying them, the following care is taken; after the collecting, immediately to be husked, and placed in the sun half an inch high upon *tampiers*, at a temperature of 81° to 83° Fahrenheit, to remain for one hour—if warmer, a shorter time—if colder, a longer time. When taken out of the sun, they are placed in a barn, side by side, upon platforms; this continues for five or six days, for a shorter time each day, and at last they are laid altogether in the barn. In the sun they are turned every quarter of an hour; in the barn five times a day; thus they remain for three or four months.

93. They are transmitted in large square baskets, lined with

large leaves, between four layers of earth, three layers of seeds; the upper and lower layer of earth must be three or four inches thick, the intermediate ones two inches; each layer of seeds must contain sixteen pounds, (Amsterdam weight) or more or less 10,000 seeds; this will be a load for two or three men. The *krandjangs* must be covered with leaves. Every evening, or every other evening, each is besprinkled with two or three quarts of water.

94. From the seed which is left every year, an oil is made both for table use as well as medicinal purposes.

CHAPTER VII.

On Nursery beds, for tea plants.

95. Nursery beds are necessary; A, if the preference is given to planting seedlings; B, if they are required for poor lands; C, if the planter will not use the dried seeds, and the land does not happen to be prepared for the unhusked seed; D, if there is a scarcity of seed.

96. They should lie in the centre of the plantation; may be long, but not broader than from three and a half to four feet, and should be raised one foot above the level of the ground, surrounded by a wall of the same height, the land ought to be light, and even in a certain degree sandy.

97. In the beds small trenches are made one and a half inch deep and three and a half to four inches from each other; in these trenches the seeds are placed next to each other, and lightly covered over with earth about an inch deep; each trench becomes on both sides, a *adjir*, about three-quarters of a foot high.

98. These beds may remain in the open air, but if required to be covered in, either for heat or rain, simple thatches are made of the leaves of the cocoanut-tree, upon posts three feet from the ground—the path *ground* itself of the beds is on no account to be covered in.

99. For four or five million seeds, 450 beds are required, each forty feet in length. The 450 beds are divided into thirty portions and fifteen of these are daily taken care of by two men.

100. Nursery beds lying in warm situations should be occasionally watered; this should be done in the evening, and as many assist

in doing so as are required; water having been previously supplied by means of aqueducts.

101. *Hipoeks* for planting out should be eleven to twelve months old and from ten to twelve inches in height; when younger they are not fit to be planted out, certainly not such as are only three or four inches high.

102. The *hipoeks* should not be pulled out, but dug out: the fence around each bed is accordingly taken away, exactly fronting the side of the bed, a hole is dug one and a half foot deep and one and a half foot broad, and the earth made nice and smooth, then with a pointed stick the plant is dug out, and it seldom happens, that the injury the roots may receive when dug out in this manner, is ever to any great extent.

103. When digging out the plants, the bastard sorts should be carefully selected and thrown away.

104. The *hipoeks* should be dispatched immediately after they are dug out; those to be planted on the plantation itself, may be sent on *tampiers*: the roots being all placed one way, and covered over with some earth; 100 to 200 upon each *tampier*; the planters being in readiness to plant them out instantly.

105 When required to be sent a distance of one or two days' journey, it must be done by packing them in square baskets of the following dimensions (inside):

1 foot 6 inches high.

1 „ 4 „ broad.

2 feet 3 „ long.

These are placed upon their sides, and a layer of earth about three inches deep is spread on it, then five layers of *hipoeks*; between each layer of plants two inches of earth; and on the fifth or last layer (which is against the other side of the basket,) three inches of earth. Thus from 600 to 800 plants are carried in each basket. The basket is then set straight, a shake or two given to it from side to side, the plants watered, then covered in lightly with some long grass;—every evening each basket is ~~was~~ watered; the earth should be somewhat moist; at night the baskets are left open, and closed up again during the day.

CHAPTER VIII.

On planting out.

106. Planting can be done by transplanting seedlings, by dry or fresh seeds, and also with seed in the pod, either fresh, or eight or ten days old. In China the preference is given to the latter mode.

107. Many advantages attend the plan of sowing with the seed in the pod; as for instance, the trouble of making nursery beds is avoided; the time and expences of planting is spared, protection can be afforded against their shooting up too high; and finer plants can be more readily obtained.

108. In hot situations however, seedlings ought to be planted out, on account of their being able from their size better to stand the excessive heat of the months of March and April, when the rains have ceased.

109. Planting can be done by offshoots and layers, *tjankoks*, likewise with cuttings, but so long as a sufficient quantity of seeds are to be had, it is better to use them; in the opposite case, the same mode of treatment is adopted with *tjankoks* as with other trees or shrubs; and with cuttings or slips the following; take seven or nine fresh slips, cut with about five or six inches of fine old wood to them, make holes six inches in diameter, and nine inches deep, place the nine cuttings in three inches square with each other: the leaves must not be plucked off.

110. For each tea plant are required:

Five *hipoeks* plants.

Or ten fresh or dried seeds.

Or eight or nine fruits, in which there are fourteen or seventeen seeds (in the husk).

The ripeness of the seeds must be ascertained by experience.

111. Planting with one single seed or *hipoek* does not produce a profitable plantation; they become plants that shoot out, but they do not become the genuine tea plants; they shoot out vigorously every year, and ~~can~~ with difficulty be kept down to a height of about two and a half or three feet.

112. Planting with ten seeds, eight or nine of the fruit, or five *hipoeks*, causes a very vigorous growth; the plants become fine, not

high, and like a clump of brushwood; full of fine, young, brown wood, with an abundance of tender leaves; the ground also round about is easier kept in order.

113. The tea plants should be planted about four feet square without shade; in width they attain a diameter of at least three feet; planting closer than this, is in the end highly disadvantageous, not only for the quantity as well as quality, but for the plants themselves.

114. On heavy slopes and acclivities, where small *pittaks* are found, the planting may be somewhat closer, viz., at four and three, or at five and two feet, and so on, and this because neither the roots nor the branches of the trees can become entangled from the steepness of the ground.

115. The planting must be done in regular rows; this facilitates the dividing of the land, and indeed is useful in the general run of the business, and also for its care and supervision; the exact spot for each plant is pointed out by the cross lines where they intersect each other; the natives are acquainted with this mode of planting, nevertheless it should always be carefully superintended.

116. The *hipoeks* must be deeply planted, at least three or four inches of the stem, with the leaves on, must enter the ground; they are instantly earthed in, leaving all round the stem a hollow about a foot in diameter and an inch deep; after the first rain, this is filled up, and the earth heaped up all round.

117. Seeds either in or out of the husk must be sown deep: holes having been made four or five inches deep, the seed is dropped in, and a light covering of earth about an inch deep is thrown in; when they have grown about three inches high, earth is cast in, and so on gradually as they increase in size, when at last it is entirely filled, and the earth heaped up round the stem.

118. Deep planting must be generally practised everywhere; it presents exposure of the roots, and promotes the healthiness of the plant, at the commencement of the third year.

119. The most favourable time of the year to plant in is November, the plants then throw out roots twice before the hot weather sets in, that is, in January and March. They can then stand the heat better and bear up against any unfavourable weather; whereas the contrary is the case when the planting is later.

120. In the beginning of November every garden ought to be ready planted within ten days, to the extent of 100,000 shrubs, that is, 10,000 each day. A sufficient number of sticks for marking the places must be fixed in the ground, by these the men must be guided; two sets of sticks of 10,000 each, are necessary in order to be able to change them; they should be counted over every evening.

121. To plant each day 10,000 plants from the nursery beds, 164 men are required, so for ten gardens each day, 1,640 men.

122. To plant by sowing the seed, scarcely twenty-five are required, so for ten gardens 250 men are sufficient.

123. Every day before the planting commences, the work must be regulated and properly apportioned, and two days before that, trenches should be dug round the trees.

124 Ten *hipoeks* should be planted in holes, one and a half foot deep and one foot in diameter, in every other respect the same as coffee, at the same time with care, so that the work is divided into five parts, and again equally divided amongst the 164 men; every plant as it is planted must be well watered.

125. In such cases watering by day is not in any way injurious to the plant, for the earth, which was dry out of the holes, and which is again used for filling up, has become thoroughly cooled.

126. The plan of planting by seed is divided into seven divisions, amongst the twenty-five men; when the sowers are active, only twenty-one need be employed, for such men not only carry the seed themselves, but do not count them out.

127. If the white-ant prevails, which very often happens in heavy clayey and poor soils, the holes in which the seeds are to be sown must be filled up with fresh garden, or what is still better, with fresh and clean clayey earth, such as has never been in any confined situation; the best is from the banks of rivers, or otherwise from recently dug ground in the vicinity of the garden; the first one and a half foot of earth is not made use of; simply placing the seeds for one night in *Katjang** oil, and sowing them on the following day as usual, ought to be an effectual remedy against the attacks of white-ants.

128. A fortnight before the planting commences, the tea plants

* A certain kind of bean.

are cut down in the nursery garden, so that it may be subsequently determined into how many divisions the gardens must be divided.

129. At the same period, and adjoining each factory, huts must be created, each twelve feet square by seven to eight in height, with a small piece of garden ground to each.

CHAPTER IX.

On subdividing the Plantation.

130. Immediately after the planting has been finished, the members of about twelve families are to be entertained, from amongst whom, one man must be the overseer; each of them should consist of one man, one woman, and two children from ten to twelve years of age. If by chance there should be one man amongst them who is able to do a little rough carpenter's work, so much the more advantageous. Each family should have a separate house to live in.

131. If the trees of the trial gardens are fit to be plucked, it is necessary to ascertain how many days have elapsed since the pruning and gathering; this number of days shows into how many subdivisions each garden should be divided.

132. On a judicious and careful subdividing of the work, depends, in the strictest sense of the word, the success of the undertaking. It should never be divided by the *bouw*. Allowing each *bouw* to be worked by one man is highly injurious.

133 A plantation should be so divided and arranged, that the work is easily supervised, both as regards the planter and the overseer himself. The gardens ought not therefore to be larger than about 1,000,000 plants. Thus a plantation containing one million plants is divided into ten principal gardens, and each garden into 35, 40, 45, or 50 subdivisions, provided always, that such dividing is according to the trial garden.

134. The subdivisions should not consist of long straggling pieces of ground, but they should be in compact squares, easily looked after; along the edges of the pathway they may be irregular, but it must not interfere with the superintendence thereof.

135 The gardens may be intersected by the pathways, but, there should not be a greater difference in the size of each than to the extent of about 32 to 40 trees.

136. The garden containing one million of trees is numbered from one to ten, and the smaller subdivisions of those from one to thirty-five; the numbering should commence at the top, with stakes marked or numbered, as a garden or section is measured off; it is marked off, and tree selected, upon which the number is fixed; a set of 2,900 stakes is required for each garden as a change, and they should be counted over each time before they are used.

137. Fences are made of the *Gandaroessa*, which is procurable everywhere; it is planted between the rows; it is not necessary to set aside any ground particularly for this purpose, and when keeping the plantation in order, this should be kept cut low.

138. Immediately after they are marked off, *number-trees* are planted in the most conspicuous places, and on these, the numbers of the gardens and smaller subdivisions are fixed; posts for marking numbers upon, are expensive and disadvantageous, subject to decay, and consequently required to be every now and then changed.

139. The best trees to plant, for putting numbers upon, are those that are of quick growth, and scanty foliage, so that not much shadow is thrown. Thus for instance the *saaij* or *gloegoe** tree, from which the Javanese paper is made, is not good, as it requires annually to be lopped; as also the *kappok*† tree, for this harbours insects in very great numbers.

140. When apportioning the work it should be divided into seven parts, and these again divided amongst twelve men, who can get ready five subdivisions each day. Thus within seven days, a whole plantation, containing about a million plants, may be divided. Two of the most active men of the lot must count the stakes.

141. The plantation being thus divided, it is finished; its maintenance thus established; and from this time the advantage of a proper apportioning of the labor, will be more and more experienced.

CHAPTER X.

On the cultivation of the Plantations.

142. Immediately after the plantation is finished, the cultivation of each division must be commenced by the twelve work-people

* Name of a tree.

† A cotton tree.

who have been already selected for employment out of the twelve families, under the direction of the superintendent. Each day they must look after one subdivision, commencing with No. 1 ; and when the whole are done, again go back and take up No. 1 ; in this manner, it is kept up all the year round, with few exceptions, they abide strictly by this sort of task-work, and are forbid to meddle with any other.

143. If through neglect, the garden has from the very commencement been left in a jungly state, these twelve men must bring timely assistance at the cost of the planter ; their wives and children may be allowed to work, being paid for the same.

144. The usual mode of cultivation is, weeding or digging with the *parang* or hoe, to the depth of one to one and a half inch ; the *patjol* may be also used, provided it is not allowed to go deeper. The *Gandaroessa* must also be cut and kept about half a foot high.

145. The weeds which are dug out are put in small heaps between the ridges, each of a distance of about seven or eight feet, these heaps ought not to be more than one and a half foot high by one and a half in diameter ; two days after these heaps have been laid out, they are burnt ; the ashes are not spread over the ground : when the laborers return after thirty-five days, the heaps are placed next to the spot where the other lay before, thus always at a distance of about seven or eight feet : in time the ash becomes spread of itself over the ground.

146. This burning of the weeds, does not in any way injure the tea plants : a plantation may be wilfully burnt down, but in a year it will again spring up : it is better however for the sake of the plantation that the fire should not be too large ; therefore the heaps of weeds should be small.

147. The smoke which on these occasions spreads itself over the plants, is an excellent thing for driving away insects.

148. By the spreading of the ash over the ground after burning the weeds, as also by regular cultivation, the land is immensely improved, and the weeds kept under.

149. In China, the one year old plants are watered with lime water to destroy insects.

150. Notwithstanding the planting, the roots come shooting out

close from the ends ; these are suckers, and should be cut off about half a foot from the stem.

151. The shoots which appear close to and round the stem, should be allowed to remain ; but under these, sometimes, and in the middle of the plant, water-shoots appear ; these are readily distinguishable by their rank and yellow look ; and if they are bent down towards the earth, they snap off ; they must be all removed.

152. Roots that have become exposed, and are at some distance from the stem, must be cut off ; those that are close to it, are first covered over with earth, and then covered in with clods reversed.

153. The plants should not be surrounded with clods of earth, as this tends to increase the chances of the roots becoming exposed.

154. The regular and constant cultivation and weeding, that is, every thirty-five days, cannot be too strongly recommended ; the system of doing so every three or four months must be altogether prevented.

155. For such however as deem it otherwise, the usual reasons will allow of the following exceptions ; to wit, firstly, not to dig for the first four months, but to commence with the month of April ; secondly, in warm localities after the first weeding in April, again to wait for four or five months, and then to commence about August and September, with the regular weeding and cultivating every thirty-five days ; thirdly, in rich bearing lands annually from November to March the grass ought to be weeded with the hoe and not dug ; fourthly, if necessary, after the lapse of the thirty-five days, to set the men to work at some other employment, for instance, cutting bamboos, after which the cultivation is again resumed ; however, the cultivation must never be interrupted during the thirty-five days, and that interruption must not last more than three or four.

156. Every three or four years there must be an intermediate ploughing ; it is only to the depth of one and a half, and only two ways once up and once down ; from the nature of the plough, which is adapted for only one buffalo, the earthing up takes place at the same time.

157. This intermediate ploughing, with a view to preserve the paths, must take place ridge for ridge one way, and ridge for ridge the other, and must be commenced at the upper end ; by way of

change the lands may be dug, and this should be in April or October, but better still if done in April, while in each garden or principal division daily one subdivision should be ploughed off. For the remainder three ploughs are sufficient; some of the people hold themselves in readiness to finish the earthing up; and thus the usual twelve people finish off this work.

158. A year after planting, about the month of December, observation must be made, as to where any bastard tea plants are existing amongst the true kinds, if so, these must be changed forthwith either by planting seeds or *hipoeks*.

159. The superintendent who has charge of the cultivation, should be every day, one *subdivision*, in advance of the people; and place, as he finds it, a mark at each bastard kind; on the following day it is changed by the workmen; in thirty-five days this is all finished; but if there chance to be many bastard plants, it may be done in twice thirty-five days, viz. each day the half; but then it must, the first time, the half of thirty-five, and the second time the remaining half.

160. The attention of the cultivators must be turned to the following points: firstly, keeping in order the ditches round the *pittaks* every day in the plantations; or, if there is no weeding from November until March, then in six at once, or six each day; secondly, the sides of the *pittaks* or *gallangs* to be kept in order, by merely cutting the grass, and allowing the roots to remain in the ground; thirdly, if the planting has taken place by seed, the filling in, and earthing up, must be done three times, if by *hipoeks*, once; the usual cultivation is thus delayed for four days; fourthly, after pruning the tree, the cuttings to be laid out in rows.

161. A plantation may fail from the following reasons: first having planted with single *hipoeks*, and not having set them deep enough in the ground; secondly, from having used unhealthy *hipoeks*; thirdly, from having sown unripe seed; fourthly, from a washing away of the earth, owing to a want of judgment in the selection of the land.

162. In the first three cases the measures that ought to be adopted must be the same as if a new plantation were commenced upon; ther, next to the old plant and close to the root a new one must

be planted in the seed ; this must be done in November ; each day three subdivisions must be worked off, being equal to 8,750 plants ; the twelve families are sufficient for that purpose ; the women and children can also assist, being paid for the same. Seed may be collected from the old plants, or the leaf may still be gathered from it, until the new can yield a crop, when the old are cut down.

163. In order to recover, in the fourth case, there must be no heaping up of earth round the plants, but fences may be raised at every two rows, and sometimes after each one, but no extra material must be brought for that purpose.

164. The plantation itself must be allowed to run to jungle, until it is about five or six inches high ; this it will do in two, three, or four months, in proportion as the ground is more or less impoverished ; at the same time sods of earth are placed there, and trenches made through. This is done in October and November ; against the attacks of insects no precautions are taken just now ; during the time the work is at a stand still, the people are elsewhere employed.

165. If trenches for protection must be made, and the perishing plants changed at the same time, then one subdivision in each garden must be worked per day ; the work is divided into ten parts, these will require thirty-six persons for each garden, and they will be found from amongst these, already in service.

166. When making the trenches, the places should be marked out the day before, by the aid of *adjirs*, for the following day ; they should be in a proper direction to guard against the washing away of the earth. At both ends of the trench, and particularly there, where they take a different turn, there should be an angle running upwards ; the direction commences from above. The *adjirs* are placed three or four feet apart from each other : there are two sets of *adjirs*, each of 2,500 pieces, required for changing.

167. The planter must not allow all the work to commence in all the gardens at the same time, but one day in two ; within five days they are all in work, and within forty the whole is finished : he is then able to superintend every thing everywhere with facility.

168. It is not advisable to exercise too strict a superintendence

over the people and come upon them suddenly and by surprise, it does not answer in work of this nature.

169. The women and children, in the meantime, must, from the very commencement, make up materials (against payment for the same,) and the men manufacture the tea which has been lopt off.

170. Where tea plantations are spread, that is, lay far from each other, so as not to be properly looked over, there must be a separate plantation made, consisting of such as are near each other, about one or two roods in circumference; each plantation then becomes placed under a separate inspection.

171. In order to administer properly that maintenance and prudence which is requisite for a plantation, the planter, before commencing thereon, must watch the progress of all labors; he will then find, that by a little order and regularity they can all be performed with few hands, and little or no difficulty.

CHAPTER XI.

Regarding the Ryots and Work-people.

172. By the commencement of the second year there are again thirteen native houses built up, the same as before, and a couple of months later also, thirteen families are taken into service, consisting in numbers the same as before mentioned. From amongst these, one acts as the factory overseer or superintendent; and it is useful to have under him a carpenter. Out of the twenty-four working men, who are now in service, the twelve best are selected for the factory, and the remaining twelve for the plantation.

173. Between the commencement of the second and third year, these twelve families keep themselves busy, together with the women and children, and separate from the first twelve, in making material, in arranging the factory, and particularly so with the lopping; while learning to lop, they pluck and make tea; they become thus, in one year, qualified to undertake and commence the gathering.

174. The women and children must be paid separately, and in the day-time, for all the work they perform, in proportion to the fixed wages the men receive.

175. This paying to the women and children, must not take

place by an increase of wages being given to the men; they must themselves receive daily some trifle, that they may be enabled to meet their own little wants.

176. The twenty-four families and two superintendents must not be under the same roof; each should have a small house for themselves to live in; the planter must always take care that they all likewise have a small garden attached; and that they are provided at the proper time with buffaloes, and as far as practicable, with *sawas* or *tipars*: this binds the people, in a great measure, to their lands.

177. Amongst the 104 people composed in the twenty-four families and the two superintendents, there should be twenty-six working men; the remainder need not be, strictly speaking, twenty-six women and fifty-two children; and the families also may consist of less than four in number, provided the total number is not less than 104 altogether.

178. The planter may have also work done by the village people; in that case these people must be especially provided with separate houses; they seldom work longer than ten days; when they go away, others coming in their places; they very soon learn the work; and then when the whole of the people are acquainted with it, this changing of people rather turns out to the advantage of the planter.

179. The village laborers do the same work as the fixed establishment, but there are no more of them taken into service than are actually necessary; the superintendent of the garden remains the whole year, the head manufacturer during the harvest, and the principal superintendent always in service

180. The twelve men employed in the mere cultivation, must be liable to be changed without further notice being given; in ordinary changes, as for instance, factory work, five days notice must be given to the heads; and regarding new applications eight must be given; there must be fourteen days likewise notice given of the number of people who will be required for the harvest time; further, the planter should keep a statement thereof, with the names and list of work done according to the forms laid down.

181. The village people must be paid as follows; for factory work

and making up material, by the job ; for cultivating the gardens, by daily wages : for plucking, so much per pound of fresh leaves. The manufacturers are paid so much per pound of dry tea, which they produce ; to procure good material, it should be procured in the plantation itself, and not made up in the villages.

182. The superintendent represents the planter, both in reference to the regular laborer as well as the village people, at such time as he is not present ; he must take care also that every man knows what is to be paid to him.

183. All the superintendents and deputy superintendents must render to the planter a daily account of the work which has been done ; these reports are made verbally ; but the planter keeps a regular and correct register according to existing forms, such of the work as has been omitted, must be attended to the next day. Particular care must be taken to prevent confusion in the daily work.

184. Under ordinary circumstances, as for instance, in building factories, changing the tea plants, putting up *gallangs*, &c., the headman of the village people must be present every evening before the planter. The work for the following day is then fixed, and this communicated in writing to the head of the village people, who distributes the orders relating thereto amongst the deputy superintendents and others, and the following day all matters progress with regularity.

185. Where the plantations of 1,000,000 plants is divided into 35, 40, 45, or 50 subdivisions, the number of plants become less, and probably also the extent of the land, according as the subdivisions are more than 35, and so much the less is then daily to cultivate, gather, and manufacture, &c., therefore, there are required for each plantation of 35 subdivisions, twenty-four families, for one of 40, 20—for one of 45, 18—for one of 50, 16, &c. ; further, the number of superintendents does not decrease, and the work is always (upon the basis of the 35 divisions,) regular in keeping.

186. In the gathering time when ten plants produce one pound of leaves, then the number of persons for thirty-five divisions as laid down, is considered sufficient ; say twelve for cultivations, two for fire-wood, two for making chests, two for bringing bamboo-leaves forty-two for gathering, four for carrying the leaves, twelve for

manufacturing, and twenty-six still remaining to be disposed of : whenever also the gathering yields one pound of leaves, the last twenty-six are divided amongst the rest, and eighteen of them to the gatherers ; consequently, under proper direction, 104 hands turn out to be sufficient. Further, men, active gatherers, can collect sixteen katties of leaves per day, here, however, only five katties are allowed per each man of the forty-two, and seven for each of the sixty.

187. To extend the cultivations of tea to forty million of pounds, 416,000 hands, £18,020,000,—should it be required that the extension takes place in twenty years, then in the first year are required 20,800 hands, and £906,000, and the same quantity required annually to be added.

188. Eight hundred thousand trees yield seed enough for one-twentieth of this extension ; the old trees which droop, and which must be changed, then shoot out ; in the second or third year these yield seed enough ; and afterwards every plantation procures seeds from its own seed garden.

189. The seed garden, the charcoal, the packing people, and the commission to pensioned work-people, are charges which do not appear in the statement before mentioned, but they will be found in other accounts.

190. The pensioned work-people should get commission upon the tea which they produce ; not for quantity but for the quality, that is, upon the price for which the tea is sold.

191. The cultivation of tea in Java is carried on in the same spirit, and the manufacture in every way the same as in China ; but the manufacturing, with more order and cleanliness.

CHAPTER XII.

On lopping the Trees.

192. The tea plants or shrubs must be lopped, so as to keep them to a certain height ; by keeping them down in their growth they are fine in wood and tender in the leaf ; and then when they bud about the time of gathering, they are found to be not more than two and a half to three feet high, which to the pluckers is of great advantage.

193. Lopping the trees prevents the superabundant budding of leaves; planting with several seeds, and especially with these in the pod, has already acted against the excessive development of the shoots, these two methods combined, produce the thin shoots and tender leaves, and the repeated loppings cause the plants to spread out.

194. By lopping is meant the clipping or pinching off, not cutting off, all the young shoots without any exceptions, to half or one inch under the brown wood, and if it be necessary scissors should be used; if the shoots thus lopped off, again bud forth and are firm, the lopping is repeated.

195. The trees are first lopped when they are about a foot high, strong and healthy: seedlings reach this height when about seven or eight months old; and plants from seeds after nine or ten months; sometimes it happens that they are a month or so later, in that case the pruning must be also so much later; pruning too early, too often, and not often enough, is pernicious; three or four months after pruning, the fresh-grown shoots are again stronger, and firm enough for the pruning to be repeated. Before the first year of gathering, this takes place three and four and even five times, according to the nature of the land; the last time three or four months before the gathering commences; after each pruning the shrubs are allowed to become somewhat higher, until they are brought to about two and a half or three feet; the pruning should never be neglected during this period; but after the second year it is discontinued altogether.

196. The leaves produced from each garden at the first pruning, must by a skilful hand be manufactured into black and green tea, and it must then be determined upon, which gardens are to be set apart for black and which for green tea; this being done, the factories can be erected.

197. A portion also of the tea from the second pruning must be carefully manufactured, and from that must be decided whether any of the black tea gardens produce more than one quality; the same with the green tea gardens; this is necessary to be ascertained on account of the packing.

198. The leaves which are produced by this and the following

prunings, serve to instruct the people in the plucking, shaking and manufacturing of the tea; a matter of the highest importance towards the success of the undertaking.

199. Every pruning of 100,000 shrubs, produces at least 200 pounds of tea; five or seven subdivisions ought to be pruned at the same time, thus the whole garden may be done in seven or five days; in this manner the shrubs are kept more uniform, as well as leaves enough obtained, for instruction in manufacturing.

200. In pruning, the proper mode of holding the hands ought to be properly ascertained, as well as in what manner the collecting baskets are filled; these baskets, likewise the racks, tampiers, &c. should be the first implements that are made.

201. Spare furnaces are also made of bamboos, plastered over with clay inside and out: further, they are formed, above, for black or green tea, as the ordinary furnaces. This kind is not advisable for large factories, but answers very well for planters who only work for about three or four days consecutively.

202. Spare furnaces need not to be erected for instructing the people; a planter, although he may be very liberal in his disbursements of daily wages, must never incur expences that can possibly be avoided.

203. The instruction to the people, with the leaves which have been lopped off, must be given in one of the out-houses, or in one of the native huts, whichever is most conveniently situated for the planter, so that he may be present; in these the two spare furnaces and materials are placed, and the people are then at once taught that the smaller planter is enabled to manufacture tea in his own house.

CHAPTER XIII.

On the Factories, the packing houses, and materials in general.

204. While no other tea is being manufactured except that from the lopped leaves, the materials, packing house, and as many factories as there are gardens laid out, should be got ready, in the proportion of one-third for green and two-thirds for black tea.

205. The factories should be built of bamboos, they are more airy for the leaves than such as are built of wood or bricks; they

take up moreover so much time in building, that the pruning, &c. &c. is apt to be neglected thereby, and the plantation suffers.

206. Every black as well as green tea factory is made with an open roof, is thirty-eight feet three inches broad by thirty-eight feet three inches long; to the black tea factory must be attached two sheds with the usual kind of thatch, each twenty-five feet six inches in breadth, and forty-four feet seven and a half inches long; in the one there must be twelve furnaces; in the other shelves, &c.: all the buildings ought to be nine and a half feet high, clear under the roof. In the black tea factory a furnace is built with four flat (*kwalies*) iron pans: in the green tea factory one furnace with two flat (*kwalies*) iron pans, another with three sloping ones and two other small furnaces.

207. Factories built of bamboo materials, tend to increase the cultivation of tea, for the ryot then sees that he is in a position to procure means within his reach; when he will no doubt endeavour to plant and manufacture tea himself.

208. It is desirable that the factories should enjoy the following advantages; 1st, the one for black should be so situated that the sun may have free access to it; and the one for green as little sun as possible: 2nd, that there is pure water close at hand to each factory, for washing the materials and for the use of the people: 3rd, that each be situated on the main road to the plantations, so as to be easily approachable by the planter: 4th, that each factory should be situated as nearly as practicable in the middle of each plantation for the speedier receiving of the leaves.

209. The packing house should be close to the residence of the planter, and that ought to be situated in the vicinity or in the middle of the plantation; it is only intended that the tea should be temporarily stowed there, for the driest, packing house, situated at an high elevation, is damp; therefore, as soon as there are twenty chests or (*krandgangs*) baskets packed, they ought to be immediately dispatched.

210. There ought to be in each packing house about ten cup-boards or almirahs, one for each plantation; but it may be possible that the plantation yields only two, three, or four qualities of tea,

in which case there will be the less number of cupboards necessary ; old ones are the best to use.

211. The packing house must be two feet eight inches above ground, and if it is to contain ten cupboards, must be of the following dimensions—forty-eight feet long by twenty-five feet broad, and twelve and a half feet high under the roof, in which is included two feet eight inches of wooden piles; which must stand upon river stone: the building is made of wooden piles, with walls, bamboo mat-work, doubled, and closely and firmly put together, a roof of thatch grass, the flooring of planks, and further a verandah ten feet wide, floored with mats.

212. Concerning the quality and nature of the materials, there are indications and a certain state attainable, which afford the clearest ideas on this point; most of them consist of bamboos, and some of iron, and altogether the cost is very trifling.

213. The planter ought to provide himself with an account of the uses of the materials necessary in the plantation.

214. The same regarding the erection of the factories and furnaces.

215. The same regarding the uses of materials for the above.

216. Also the same, of that concerning the packing house.

217. The size of the factories and out-houses, as also the quantity of material that may be required is calculated at the production of one pound from ten shrubs; should, however, one pound be obtained from five shrubs, then it will be necessary to reduce every thing by one-third, except the packing-house; that remains the same.

218. The planter should endeavour, ere he commences, to have models made of every thing, and appropriate to his services the descriptions and drawings at the same time; the principal part of the bamboo materials are made of the same kind of mat-work, and every year, before they are again taken into use, they should be washed clean, and further care must be taken that each kind is made precisely after one model, and they will then be uniform.

CHAPTER XIV.

On the Tea baskets and Tea chests.

219. After the tea is manufactured, it has still to undergo further operations and then be well packed.

220. For this purpose they have separate establishments in China; in Java, at Mr. Corneli's, near Batavia, there is one of these establishments; on account of the dampness, it is not advisable to have them in the plantations, they likewise interfere with the planter, when his object is to produce quantity as well as good quality in his teas; the Chinese planter consequently thinks solely about the production and manufacture, leaving the remainder of the work to be done by the others.

221. The teas are therefore delivered to the large establishments in large sacks, baskets and chests, but such as are not fit for exporting it in; this is also done in Java, but there, no doubt, before long the planters will commence to deliver their teas in such chests as will be good enough to have the same exported in.

222. The Chinese baskets are double, and all made of open-work; between the two bamboo leaves are placed; in Java the bamboo leaf is not so well adapted for the same purpose, and the baskets there are consequently made closely worked together, lined inside with the leaves, and over that again a thin paper.

223. The Chinese planter never packs fresh tea so as to exclude the air from it, as in that case it would not be freed from the *musty* sharp smell that it has, and it is for this reason that he uses sacks: and the chests are sent with their covers open, and placed in open-work baskets, and then despatched; some people assert that it is done to facilitate the inspection of their contents by the Customs' Officers.

224. The baskets must measure in diameter two feet two and a half inches, in height two feet seven and seven-eighths of an inch, the cover should not go deeper than nine and a half inches; they will then carry as near as possible about 100 pounds of tea.

225. The *Bambootalic** and the *Bambootemon** produce the largest leaves, therefore they should be taken from these trees; at first they must be placed in an out-house or shed to dry by the wind, to prevent their heating, and afterwards they must be placed, between two heavy planks, to make them smooth and even; the tops or points must then be cut off about two inches, the leaves fastened together by small bamboo pins, making sheets of them of about two feet ten

* Particular kinds of bamboo.

and a half inches square, when they must be again dried and laid, until required for use, between two heavy planks.

226. For each plantation there should be two men employed the whole year through for making baskets, as well as bringing the bamboos; they will be able to finish off in three days one or two baskets complete with their covers.

227. Each basket will require about six sheets of the bamboo leaves: two old women must be employed the whole year making these leaves up, and if they prefer it, they might be allowed to do so in their own dwellings; they provide themselves with leaves, and ought to make up about four to six sheets daily.

228. The wood for the chests should be of a light description, not liable to rot: and be moreover dry and without the slightest smell, for the green tea it should be of a light color, and that for the black of a dark color.

229. Tea chests for the European market must be light and strong, both as to wood and lead, also well closed, and with an air-tight, simple, although neat, and even sometimes of a flowered covering; further provided with marks and inscriptions according to custom.

230. In China almost all the chests are made outside of the plantations, and such as are made in the neighbourhood have the outer covering done elsewhere.

231. In Java the practice ought to be to have the chests made in the neighbourhood; with that view, the planter must bring up two of his carpenters as master carpenters in a separate establishment; then they are taught the order and regularity of this trade, and are speedily enabled to instruct others.

232. He accordingly assembles together twenty men, that is, two from each plantation, in one of the out-houses, which serves as a place to work in; the two master carpenters instruct the others, that is, the other eighteen men; altogether they are enabled to make five chests each day, thus 1,500 are made in 300 days; strictly speaking, those twenty men, can with order and industry deliver at least 2,500 chests in that time, and that without any extra exertion on their part.

233. After the second pruning, the planter can tell what kind of tea his land is to produce; he therefore generally requires to have

ready two or three different sorts of chests on this account, the size of the chests for each kind is previously determined upon; each however will generally contain, more or less, about sixty pounds (Amsterdam measure), according to the size of the leaf. For 100,000 pounds from one plantation, that is, 10,000 from each garden, or from ten shrubs one pound, in an average about 1,500 chests will be required.

284. As long as the manufactory cannot supply chests, the planter should endeavour to procure them elsewhere to carry on with; these should be also of a certain size, which will contain more or less 100 pounds (Amsterdam) weight. For 100,000 pounds accordingly 900 will be required; it is always however desirable, that such as are actually required be procured, and no use made of the fourth sort.

285. The four sides of the chests, must consist, two, of two planks each, and two of three planks each, the planks properly joined to each other; or each of the four sides may be of one broad and one narrow piece of plank; but so put together that the joinings of the planks do not come opposite to each other; the tops and bottoms, although they cannot always be of one piece of plank, must never be of more than two breadths, and in the last case, the joining must never be in the middle; in this manner small or narrow planks can be made use of in the making up of the chests. Planters, who may find it difficult to get wood-work done in the immediate vicinity of the factory, must procure ready-made planks, and of the proper dimension for constructing the chests from some other source, so that at any rate they can have the chests made up at the factory and under their superintendence.

286. The leaden boxes are in the meantime delivered to the planter, according to an agreement already entered into, cut to the proper dimensions, folded up, and ready to be put together; this is easily done, and they are placed in the wooden chests, according to the method pointed out for that purpose.

287. The wood and leaden boxes both can be made at the rate of florins* 83.71 cents each, or 1,500 in the twelve months, and florins 3.29 cents each, when 2,500 are made, and if the leaden boxes are

* One florin or guilder is equal to one shilling and eight pence sterling.

made in the factory, these at florins 2.88 cents for 1,500, and florins 2.46 cents for 2,500, and even at a lesser cost.

238. The planter must always bargain to have the chests made, each at a certain fixed price, although he may employ his own people, although it may happen even, that by any unexpected exertion on their part, they may make them to a profit; he is sure in that case, that they will be ready at a proper time; it is therefore to his own interest to give the work into the hands of his own people.

239. Finally it is of the utmost consequence with a view to the more general cultivation of tea, that the preparation of the chests goes on close to or adjoining the factory; there will be less necessity for erecting expensive buildings, and the consequence will be a range of suitable packing houses, in all the residencies, or in the vicinity of the plantations.

CHAPTER XV.

On Fuel.

240. For drying the teas both wood and charcoal are made use of; the latter only however, when the drying is about being finished. The fuel is only required to be lighted during a portion of the day when the drying commences.

241. At the time of gathering, or the harvest, when 10 shrubs yield 1 pound of tea, and one garden, 100,000 trees, gives 10,000 pounds, that is, about 70 pounds per day, there will be required for each factory 3 *pikolans** or $\frac{1}{3}$ of a *toembak*† and 1 *pikolan* or 70 pounds of charcoal, making at that rate, say 420 *pikolans* firewood, and 10,000 pounds charcoal, and for the whole plantation three times that quantity. Should the gathering be more productive, and 5 shrubs yield 1 pound of tea, the necessity for an increase of fuel will only be to the extent of 3-5ths of the above mentioned quantity, and in that case each will require 672 *pikolans* fuel besides 16,000 pounds of charcoal.

242. A bamboo shed must be built for the storing the wood in with a flooring of mats made of bamboo. It must be large enough to stow away 20 *toembaks* or 480 *pikolans* of wood, to within 2 feet

* A load.

† A measure of factory 12 feet long, 1½ broad, 6 high.

of the roof, there should be a door on one side for taking out the wood, and on the other, one for bringing it in through; the oldest wood is then used first; previously to placing the wood in the house, it should be exposed to the sun and wind for a couple of days, and then remain inside for one more; again, before it is used it is put into the sun, or in the drying baskets over the fire, to be thoroughly dried ere it is made use of.

243. The two men intended for cutting the wood, can bring in (each of them, daily 1 or rather) 420 to 672 *pikolans*, in the 300 days; their wages are 120 florins per annum, that is to say, for 420 *pikolans*, being at the rate of 28½ cents each, at this rate the fire-wood becomes much cheaper in many places than it otherwise could be.

244. The quality, particularly of black tea, depends chiefly upon the use of the best charcoal, for bad charcoal damps it; it is necessary therefore to use Chinese charcoal ovens, and the charcoal itself must be burnt after the Chinese method, and from the hardest kinds of wood. The spot for making the charcoal should be selected close on the side of the forest.

245. For a plantation yielding lbs. 100,000 of tea, five charcoal ovens are necessary; they should be, as far as is practicable, placed against a sloping bank of a stiff clayey soil, and close together, then a bamboo roofing is made to each, and lastly the whole is surrounded by a water-course from top to bottom. Whenever the clay soil selected fails to be of the best kind, a wall is built to the extent of half a brick in thickness, for which purpose 2,800 bricks and 28 tons of lime are required.

246. The ovens must be numbered from 1 to 5: they should be filled, one on each consecutive day, according to its number. On the sixth day, the coals are taken out of No. 1, must be cleaned and placed on a platform under a shed, and the oven refilled, &c. &c.; three men bring in four-fifths of a *toembak* of wood, that is, thirty-two logs, each five feet in length and half a foot in diameter or thinner, but not so much as two inches in the diameter, and not shorter than five feet; it must be green wood; each oven should be filled with logs as uniform in thickness as possible.

247. To produce lbs. 100,000 of tea, lbs. 100,000 charcoal, by

a tolerably close calculation, is requisite; each oven can turn out, from the heavy sorts of wood, daily at least lbs. 626 of charcoal, thus within a space of 200 days lbs. 102,570 of charcoal can be obtained. For a harvest of 1 lb. of tea from five trees, lbs. 160,000 of charcoal will be required, therefore it is better to lay down two places for preparing the charcoal each containing two ovens, which, attended by four men at each, would produce lbs. 164,112 within 297 days.

248. No more than four-fifths of a *toembak* of wood is put into each oven: the wood should not be placed lying down, but on the contrary, in an erect position, that the moisture may run out; two pieces of wood must not therefore be placed one over the other. The entrance is then stopped up, and a piece of wood about an inch thick placed over each chimney; the fire is kindled, and if in a day and a half to two days after the two pieces of wood have become cooled, then both the mouth of the oven and the chimney are plaistered with clay and made air-tight; further, the charcoal is then allowed two days to become extinguished; from the very commencement, whenever the roofing on the entrances or the chimneys crack, the crevices should be immediately closed by plaistering them with the glutinous exudation of the bark of the *Waroe* tree; if the charcoal be of good quality, it should chink like porcelain, if otherwise is has a dead sound.

249. A place for preparing charcoal having 50 ovens requires the attendance of five men during the year; three cut wood and despatch it, two fill the ovens, empty out the charcoal, and plaister the roofing, &c., as required, &c., &c., the others despatch by harvest time 1 *pikolan* per day: thus the *pikolan* of lbs. 65 costs 19½ cents, and with the cost of transit 25 cents. It is advantageous therefore in delivering out the charcoal to adopt the course above pointed out.

CHAPTER XVI.

On Thinning and Pruning the Trees.

250. In the commencement of the third year after planting, that is in January or February, the harvest commences, previous to which a pruning and cleansing of the trees takes place at the same time

they are thinned; from the end of July to the beginning of August, the harvest is brought to a close; this takes place annually. If the planter allows delays in working the system pointed out, a certain loss arises in tea cultivation, but otherwise it is a rich source of profit.

251. After the lapse of two years the first harvest commences. Some judgment is necessary in fixing on the first day with a view of its being finished by the end of July; three or four months before the harvest begins, another lopping of the trees takes place, notwithstanding which the branches still shoot out, and produce a quantity of matured leaf.

252. By the time the leaves are matured and the rains of Nov. and Dec. have set in, the branches have grown out luxuriantly; therefore in January and February many young leaves have made their appearance, these are then gathered previous to the pruning; this is the first gathering: every year this takes place.

253. One day before the pruning, this first gathering takes place, sometimes even three or four days before but never earlier, for in that case the harvest would be injured.

254. If about ten or twelve days before the pruning time the plants should happen to be covered with young leaf, they should not be gathered; the planter must, in no case, desire, by an early gathering, though the tea be good, to increase the harvest.

255. The gathering should take place in one park at a time; if there be a scarcity of leaf, the collecting may go on in three or four parks, but never from more; three or four days before the gathering commences, and on every day thereof, a regular watch must be kept.

256. The plucking and manufacturing of both black and green tea take place in precisely the same manner as during the regular harvest; the top leaves by themselves, the fine and centre ones together: these last and the coarser kind the people must separate by passing through a sieve and picking: then it remains but to have the working materials properly cleansed and set aside.

257. The planter must consider the first gathering of great importance, that he may keep the process in the recollection of the people, and give further such instruction as may be required.

258. The day after the first gathering pruning goes on in the park; should it have taken place in three or four at the same time, the parks are pruned in succession; eight men are sufficient for that purpose; it is better to employ eight or even fewer pruners, provided they are expert, than to employ more hands, and these less skilful.

259. The pruning, after the first year, is carried on only in two gardens at a time, for instance in garden No. 1, then in garden No. 2; the following day in garden No. 3 and in garden No. 4. The day previous the pruners are instructed; the planter does not allow them on the day the pruning commences to prune altogether, but each man has a separate row to himself; once more he receives instructions, and then goes on pruning his row under the superintendence of the overseer. The following day all the 8 pruners commence work at the same time.

260. The pruning is done by rows; for instance, if the pruner of row No. 1 has finished it before the pruner of row No. 2 has finished his, he must not assist No. 2, but proceed to row No. 9 at once. He is at liberty, however, then, to prune two rows consecutively; but, as the day's work closes, and the last rows are being finished, the men may then assist each other.

261. Every successive day one park should be pruned, not even a dozen trees should be allowed to remain undone till the following day: should it be apprehended that in any particular quarter delay may occur, this should be guarded against by providing assistance in good time from those gardens where the work has been finished early.

262. The planter must excite rivalry among the workmen of each garden, and further amongst those of one garden with another, then they will be able to get through their work without assistance, for the work is not heavy, boys can prune as expertly as men;—the regular course of the work depends upon the Superintendent; every irregularity during the pruning time is prejudicial to the gathering, and therefore destructive to the harvest.

263. The Superintendents inspect each park the day after the pruning; they direct every thing to be put in order, particular attention being paid to the thorough cleansing and weeding round

each tree; cleanliness, especially in the harvest time, is of the greatest consequence; the earth around each is in the first place loosened and then carefully heaped up, and pressed about the tree; then round every two or three rows of trees the loppings are heaped up in thick rows; not however in contact with them but parallel.

264. The planter should place considerable value on these cuttings or loppings, for what with dew and rain the moisture which runs of them speedily ferments and forms the best possible manure for tea lands; it improves the flavor of the produce; after three years the improvement is easily perceived; for this reason old tea lands are renewed by replanting, but are never abandoned.

265. Plants properly lopped and therefore healthy, are pruned when about a foot and a half high for the first time, and then annually. When they have grown to a height of two and a half feet another pruning takes place. Most of the plants at an height of two feet and some few at two and a half. The branches shoot out from half to three-quarters of a foot, the plants therefore must not be pruned higher, otherwise it becomes difficult for the gatherers to get at all parts of them; in lands with a sunny aspect you must be guided by experience.

266. If the lopping be neglected, or the plucking, which is the same thing, take place unseasonably, the plants become straggling, and grow too conical, and consequently top-heavy, many smaller branches shoot out below, growing close together, and bearing no leaf, the wood of which becomes heavy, grey, spotted with white and mouldy—the plants inwardly or poor, and bare of leaves—these then should be pruned at a height of one and a half feet.

267. For the regular, and irregular pruning there are four rules, which apply equally to all, for instance—A. the time of commencement of the same—B. the pruning upwards—C. the using of sharp pruning knives, and D. the freedom as regards pruning.

268. The pruning should not commence earlier than the middle of January, or even a little later, so that it may take place just as the rainy season breaks up.

269. The pruning should be *upwards*, not by clipping off the tops of branches, for without care they are liable to split, the rain soaks in and injures them.

270. Good and sharp pruning knives should be used; to facilitate the cutting, and thereby prevent as much as possible all shaking and rough handling of the tree, each pruner ought to be supplied with a sharpening stone, for use when required, and the day's work being finished, the pruner must not quit the plantation without having first put his pruning knife in order for the following day's operations.

271. There is no particular height at which the trees should be pruned, and supposing the average height to be about two feet, though there are others only eighteen inches high, still they should be pruned some two or three inches to cause them to shoot out.

272. Annually, as the time of gathering comes round, the trees are found to be ill grown and mishapen, their branches irregular, the leaves hard and growing closely together, full of dust and dirt, covered with dead insects, and altogether appearing of deep green and in an unhealthy state, so that without the operation of pruning, they would never shoot out as required.

273. The trees must never be so pruned as to leave them perfectly leafless; they should always be left on to some extent, even to portions thereof, for they act as channels for conveying the rain and dew for nourishing of the plant.

274. The ordinary *pruning* scarcely deserves to be styled pruning: it is rather, a cleaning, trimming, cleansing, and thinning out of the plants

275. In order to prune well, quickly and lightly, the knife should be taken in the right hand; and with the left as many twigs grasped as can be firmly held by it, when having turned the same towards you, they are to be at once cut off in an upward direction; this is repeated, the plant is neatly trimmed, air is given from below, all creepers are pulled and thrown away, all the small dry twigs and branches are cut off to within two eyes, and the knotty and crooked ones to within one foot more or less. The decayed leaves are cleared off, and the old ones pulled off with the hand, without however making the plant too bare.

276. Towards the close of the day's work the overseer having had the grindstones placed alongside of each other, sees that the pruning

knives are properly cleaned and sharpened by the pruners for the following day ; further, during the course of the day he must take care, that the workmen have been careful in their work, and placed the clippings tidily in rows as they have gone on, &c. &c.

277. Such plants, as may require an unusual pruning, must be cut down at once to eighteen inches ; they are allowed annually to run up until they are about two and a half feet high ; all branches and twigs will not allow of this ; the pruning knives now require to be firmly examined and firmly fixed in their handles, as they frequently separate, on account of the thickness of the branches that have to be cut.

278. When pruning down to one foot and half all must be at once cut off to that mark ; when it so happens that a branch is found, having two or three straggling shoots upon it, those should be all cut off, provided it leaves the branch about a foot and half in length ; but if it should leave the branch only a foot and quarter long, in that case, the shoots are left in but cut, leaving only an inch or an inch and a half of them ; the plants are then trimmed and rounded off, and finally, whatever remains to be done, is finished off in the same manner as at the general pruning.

279. From 12 to 14 stout, hard-working laborers are necessary. In this extra or unusual, though simple pruning, every day, say for a park of 2,857 plants, the planter must carefully watch and see that the work is not overdone, for the workmen are very apt at times to hack away until they have nearly cut the plant down to the ground ; if the work is well done, the planter will have the satisfaction to see the plants bud in 15 days, in 10 more they will sprout out, and by the thirty-fifth day the leaves are fit for plucking, but still they are not yet to be plucked.

280. Plants, well looked after and cultivated, become in from 8 to 10 years very heavy in wood below. According to the nature of the soil, the produce thereby decreases ; if this happens, then the following year after the pruning, the plough must be used, should that not avail, again the following year an extraordinary pruning must take place.

281. These plants are thus pruned, in the former manner, as those which have been badly taken care, with this difference, that

they are cut down to one and a quarter. In 35 days after, the picking or harvest takes place; during this harvest the plants are run up as much as can possibly be done to 2 or 2½ feet high, and then the annual pruning takes place as before, until they again require an extra one.

282. The quality of the tea the first time, after an extra pruning, is not so good, but it improves at each gathering; and by the fourth, it is as good, as at first. In China, where this system of pruning and extra pruning is adopted, as above related, the plants or trees produce for a period of from 60 to 80 years.

283. In anticipation of the gathering it is necessary that 2 or more ware-housemen be engaged, and daily instructed in the nature of the work that will be required of them.

CHAPTER XVII.

On gathering the leaves for Tea.

284. At the lapse of 35 days the first gathering may be commenced upon; in cold districts a little later; the 10 first parks of the plantation should be finished by taking the gardens 2 and 2 or 3 and 3 at a time in each day, according as the planter may have arranged this at the pruning time; for the gathering is regulated by the latter operation; the planter should endeavour to commence gathering by the first of March, and thus avoid the heavy rains.

285. Four gatherings take place in each garden; each gathering lasting 35 days, which, together with the pruning-time, 175 days; with the view of obtaining healthy shoots the gatherings are retarded generally, particularly the interval from pruning until the first gathering; this prolongs the harvest well on the 190 days, commencing on the 24th January with the pruning, and on the 10th March with the gathering, is considered favorable; the planter must nevertheless always exercise his own judgment in this matter.

286. Gathering during rain is very injurious to the flavor of the tea; dampness moreover is apt to cause it to lump, by the leaves sticking together; and, while there is no sun the cylinder cannot be worked, nor the tea well shaken; the quality is therefore very inferior.

287. Showers of rain during the dry season, cause no serious injury, for the leaves do not become swelled by such rain, and the sun appearing saves them; the later thus in March that the first gathering commences with reference to the pruning, so much the better for the tea.

288. The leaves which are plucked from six to eight o'clock in the mornings, are covered with dew, and are in consequence less fragrant than those taken during the remainder of the day, and which have benefited both by the sun and wind; in general, however, the tea runs out good; it is always as well to have expert gatherers, and commence the 2nd, 3rd and 4th gathering at eight in the morning; if rain is expected, then at six o'clock; the gatherers must always be in attendance by six o'clock in the parks.

289. Before a fresh gathering is begun upon, the planter must inspect the plants, that he may judge on what day the gathering can commence. From the 20th day after pruning until the 34th, he must examine the plant four times, and determine on the 35th if the gathering can begin on the following day; if he be an experienced planter, inspecting on the 34th and 35th days will be sufficient.

290. Under any circumstances the planters should on the 34th or 35th day make the following examination on 2 or 3 branches of each tree or plant, to see if they are ready for plucking, &c., for instance, he plucks off upwards, the 3rd leaf, then the 4th leaf, and then the 5th leaf, if the stalk remains broken off with a small piece of the leaf attached to it, even in the case of the 5th leaf, then it is too soon, but if the 3rd leaf comes off in that manner, the 4th not so easily, and the 5th still less easily, then it is just the right time, and the gathering should at once begin on the following day, or if necessary, one day later. In cold situations, the leaves remain tender much longer, the labor lost under such circumstances requires consideration; sometimes a leaf ripe and fit for gathering, comes off above the stalk, one that is somewhat leathery in the stalk take off the eye with it, and another, a somewhat more leathery one, breaks off at once in the middle.

291. The planter who has experience enough to be able to judge of this by the eye, should nevertheless satisfy himself of it, for the

leaves spring from the top of the shoots; and often two at a time: the age of them thereby becoming gradual.

292. To put this test into practice the leaves must be held by the middle joint of the fore-finger and thumb; then gently pulled upwards; otherwise, being a tender leaf, it breaks off in the middle.

293. The planter must hold this enquiry himself, for upon the gathering depends the out-turn of the harvest; if the leaves are too young, they are too tender for manufacturing, and the shoots in following gatherings weak; and should they be too old, the tea is sure to be inferior, and on the other hand the development of the buds is too early.

294. If any mistake occurs, it must be immediately remedied; if for instance the gathering has commenced too soon, it must cease for a few days, until the leaves in the adjoining park are ready. If it has been late the men must be set to work and the gathering proceed in two parks at the same time, so long as there are plants shewing leaves fit for plucking, after which it can be continued one park at a time.

295. Before working double tides, care must be taken that for such number of days at any rate, extra pluckers and manufacturers be provided; nothing, not even the extra expense incurred thereby, must prevent the planter from doing double work when required.

296. The gathering takes place in three divisions, for instance, the first upper leaf, which is still unfolded, together with the next and last expanded one; fine leaf, or the second and third together; middle leaf, or the fourth and fifth together; when there happens to be a sixth or a seventh leaf, and it be tender, they should be plucked with the middle ones. The day preceding, the attention of the pluckers is once again called to the above method; the coarse leaves are picked out of the tea after the manufacturing.

297. Distinct sets of pluckers must be provided for the different kinds of leaves for both black and green teas; those for the middle leaves must be the most expert, and the Superintendent must pay most attention to this man, because he must be careful in leaving the buds for the next gathering; the gathering must be carried on

in three parks at once; in one the top, in the second the fine, and in the third the middle leaves.

298. Calculating one pound of tea, for every ten trees, twelve pluckers should be provided for each kind of leaf; as each man finishes he must go and assist the others; such as wish to help those gathering the middle leaf, must be good men; it is better to employ few, but expert gatherers.

299. The plucking must be conducted in the same manner as the pruning, row after row, and be finished daily, in each park.

300. There must be two or three buds left on each shoot, or if needs be only one; the shoot is then cut off, a finger's breadth above the bud; the bud should remain protected, even if it is only by a small portion of the leaf; after the first gathering, each twig throws out two new shoots, thus more tea is produced at the second gathering; by the third gathering there are still more shoots, but the leaves become smaller; this is the case also at the fourth gathering. A judicious reserving of the buds, increases the crop; but a too great sparing of them diminishes it.

301. The leaves for black tea must be plucked together with the stalk, just under the tea, thus: first top, then *fine*, and then the *middle* leaf, should the *middle* leaf pluckers observe no buds below the fourth and fifth leaves, then they must pluck the leaves only with the view of preserving the buds.

302. The *top* leaves, for green tea, must be nipped off, but the *fine* and middle leaves, must be plucked off upwards, without the stalks; the pluckers of the middle leaves must nip off the stalk separately, leaving two buds, and throwing away the stalk. The *fine* leaf pluckers must take care that the stalk remains on the shoot, with a small portion of the leaf attached to it.

303. *Pecco* is made of the top leaves of gardens intended for black tea, and *Joojjes* from those intended for green; should the planter in consequence of a greater demand for other sorts wish to obtain them, for instance, if he wants to make more *Pecco*, or a finer quality of it, or to make more *Joojjes* than *Pecco* than the plantations in the long run are able to supply, and he desires the two first, i. e., more *Pecco* and a finer quality of it, he must, in that case, commence operations by gathering, first, the fine, then

the middle leaves, and lastly the top leaves, making thus *Pecco*, and this from the gardens from which it was intended to be made.

304. When the top leaves are destined to be appropriated for this purpose, the following rule must be attended to; firstly, in both cases where more *Pecco* and finer are to be made, the pluckers of the top leaves must nip off the stalks, and be the most particular of all. Secondly, the tops must never be allowed to remain more than two days to be developed, when intended for *Pecco*. Thirdly, *Pecco* made from the top leaves from green tea gardens, must be manufactured in the black tea factory, and *Joosjes* from leaves from black tea gardens in a green tea manufactory. Fourthly, the green and black tea gardens, in which the change of leaf for the manufacturing as above takes place, should be close together. Fifthly, the changing of the fine or middle leaves should not be mutual. Sixthly, in new tea-plantations on account of the exchange, there should be no deviation from the usual course.

305. All the baskets for gathering tea in, should be of the same weight; they should be fastened at the waist in front, in such manner that the leaves may be handily and with care thrown into it. They should never be placed on the ground on any account.

306. The people may pluck with both hands at a time; the hands, rather fingers, should be held as if the game of marbles was being played at, but with the thumbs lightly pressed upon the fore-finger. The top leaves can thus be finely and easily secured by the stalk (or, in the case of green tea, leaf by leaf) between the finger and thumb, and nipped or pulled off. As the leaves are picked off they are collected in the hand. Five or six plucks being taken, they are thrown lightly into the mouth of the basket, the men proceeding actively with the gathering; the leaves must not be held long in the hand.

307. Besides the care and attention therein bestowed by the planter during the gathering, he must recollect every now and then to call out to the people to be careful in plucking in an upward direction, not to retain the leaves long in their hands, and to leave the two buds that are required.

308. Four *djongdong* or covered baskets must be every day brought to the pluckers for the purpose of conveying away separate-

ly, the fine and middle leaves; two being^{*} taken away full, the other two left for filling. The top leaves are sent away in *sonkos*, or small baskets. The *djongdongs* or covered baskets with black tea in them may, if the weather is fine, be kept open in the plantations, but those with green tea in them must be kept shut. The leaves, both for green and black tea, should be always quickly carried away to the manufacturers.

309. The gatherers should be paid by the weight, which is reckoned in catties, and have tickets given to them; it should come to about the same as their daily pay; they can one with another, pick at least five catties of tea per day; when fines are levied they should be from the weight, not from the money; each basket should contain only two catties; the weight must therefore be somewhat under two catties; five catties is only taken as a sort of guide to go by, for good active pluckers can gather often sixteen catties per day.

310. Two hundred and twelve tickets are necessary for each factory, making seventy pounds of tea per day, although there are already 300 of the tickets on hand: with these the gatherers are paid for the time, then in the afternoon these are exchanged for their pay in money.

311. Each time, as the leaves are brought in, they must be weighed and noted down before they have time to shrink.

When the day's gathering is finished, a memorandum of the total weights is given into the planter; if he finds any difference in it with the tickets, he must enquire into the matter and settle it.

312. If blight and insects make their appearance just at the season of the harvest, it must not in any way put a stop to the regulated period of its commencement, and must be proceeded with: for, in the first place, they are mostly best got rid of, when they are taken off together with the leaves, and they are again afterwards sifted from them, whereas any delay would tend to injure the succeeding crop.

313. After the fourth gathering the plants shoot out very freely, but though this be the case, there must not be a fifth gathering, for it would prove injurious to the following harvest; but in warm districts, when the lands can be irrigated and the leaves are fit in about thirty days, a fifth gathering may be undertaken,

314. The practice of gathering at the end of fifteen days is objectionable, for the shoots are thrown out uneven, and the produce is not at all greater; at any rate, those who adopt this plan, must pick from two parks at once, for even then the shoots scarcely show leaves enough, although a change has taken place; further, the top and fine leaves are picked as usual, and for the middle leaves only the middle. The period of commencing and finishing the harvest remains just the same.

315. The harvest cannot be continued throughout the year, as that would exhaust the plants too much, and produce but a small crop.

316. If the cultivation of tea is to become a branch of industry, the harvest throughout would be impracticable.

317. It would be a good plan to make four trials; to effect this there ought to be five plantations adjoining each other, each containing 100,000 trees; they should be all laid out at the same time, all planted from seed, and the seeds produced from one and the same garden. The first garden then, is for four gatherings, the second for five, the third is to be plucked at the end of fifteen days, the fourth the whole year through, and the fifth again for four more gatherings; but then, the 1st, 2nd, 3rd, and 4th, must be planted four feet square, and the 5th, three feet; in 10 or 15 years, it will become the best plantation.

CHAPTER XVIII.

On the manufacture of Tea in general.

318. The manufacture of tea intended for commerce, both black and green, is all over China the same, with little deviations. The difference in the produce is owing chiefly to the different districts, and the general knowledge of the manufacturers; sometimes the rolling of the leaves is done with the feet, and green tea is sometimes made by the women sitting before a low furnace with flat lying *kwalies*.

319. The teas in China bear about 70 different names, so termed from the hilly districts, and circumstances connected with the growth and manufacture, they differ in all districts. The names by which they are known to commerce, are given where they are finally prepared.

320. In Java only one system is adopted for both black and green tea, made by hand only. The different districts produce great varieties, but only four denominations are given to all the residencies, *viz.* top, fine, middle and coarse leaf. The terms known in commerce are also given at the place of final sorting and packing, and there it is that a general knowledge of the different kinds develops itself.

321. It is a rule that every year with the appearance of the first flush of leaves, the pluckers or leaf gatherers, the manufacturers and other warehouse men, each in his own sphere has to clean the materials and pans for the manufacture.

322. Each planter has to adopt a plan and prepare a form, showing for each day how much leaf has been gathered, how much tea has been made out of the leaf, the state of the weather, and how many pounds of leaves have been required for a pound of tea; this is one of his duties.

323. Immediately after the weighing of the leaves, they should be manufactured, and care be taken to produce good quality; otherwise the tea will be light and of an inferior make. A plantation of a million of bushes should easily give a return of 50 to 55,000 florins or guilders per annum.

324. To enable a planter to make good tea and to know how to do it, he should stay for a few days in a good factory; by looking on with his own eyes, he will detect and observe details in the work, which would otherwise escape his attention, but which show the slight deviations unavoidable in practice from mere theoretical rules; he will find out, that no harm is done by such details, and the trouble less than he ever thought of.

CHAPTER XIX.

The Manufacture of Black Tea.

325. The leaves should be exposed to the sun immediately after they have been weighed, and as soon as they become slightly soft this is accomplished; when little shining points become visible on the leaves, or a brownish tint with brown spots on the edge of the leaves, it is time to bring them to the *leaf house*; bye and bye they become dark blackish brown; this is termed withered.

326. Sun is necessary for the tea leaves to bring out the flavour, but changeable weather makes it difficult to determine how long they should be exposed in this way; however practice will soon teach this.

327. During the manufacturing season the sun is almost daily visible and even when the sky is cloudy the opportunity should not be lost to have the leaves in the same manner exposed in the open air; as a rule it is generally presumed that fine leaves (the best quality) require 20 minutes, middling 25 and the coarser about 30 minutes; thus the inferior leaves require the longest time for exposure.

328. A little breeze is favorable to promote exhalation and withering; however with a strong wind care should be taken to protect the leaves from being blown away.

329. A speedy exhalation is necessary as well for the quality of the tea as for the general course of manufacture. It requires an occasional shaking or tossing up, and the leaves should not be kept for the night without this previous process, or it will be detrimental to the produce.

330. The leaves should not be handled, except when assorted and scattered in the sun; after shaking on the trays and separating them they must not be (handled) until they come into the *kwalie*.

331. There is a peculiar way of shaking the leaves up with the hands while on the bamboo trays which every manufacturer should learn from the very beginning. It is a swinging movement like the deck of a ship at sea, and they should do it at first with mulberry leaves or if needs be first with fresh grass to practise it.

332. The peculiarity of the motion is, that the leaves on the tray roll in a slow circular and rising course, they touch each other softly, turn at the edges, mix more or less with the leaves partially withered, and thus assume a similarity during the time that this shuffling is going on.

333. In order to bring the leaves in such a motion, as above described, the *tampier* (bamboo tray) or sieve is held above the hip, (the left hand about $\frac{1}{4}$ and the right hand about $\frac{1}{3}$ part of the brim) and begun with a gradually increasing movement to about 60 turns in a minute, at last bringing the leaves in an oval shape on the surface.

The sunning of the leaves.

334. To explain the sunning and shaking of the leaves, we proceed to show the course of manufacture: the leaves are weighed on arrival and spread over the tampier or trays by guess, about $\frac{3}{4}$ of a pound on each, and then put the same in rows or side by side on tables in the sun.

335. In the course of 20 or 25 minutes every tampier or tray has to be taken in turn, and tossed 40 to 50 times; in this way 50 to 60 trays may be treated in the course of 20 to 25 minutes; at first only 20 to 25 tampiers are given to one man employed in sunning the leaves, later on 40 trays, while others are busy in spreading the leaves which have newly arrived.

336. After 20 minutes or thereabouts, before the second tossing is given to the leaves, the contents of two trays is put upon one, and now the man engaged takes off the second supply of leaves another 10 to 15 trays for the first tossing; in this way each laborer looks after 20 to 25 trays, the further supply of leaves is now spread out by another set of men, for which the time required becomes a mere matter of calculation.

337. After a further lapse of 15 minutes the same process is repeated, the second supply of green leaves is put to the first, the contents of two trays upon one; there is a little pause of a few minutes before a further supply is on hand between the second shaking is given to the leaves as before described, and a fresh supply of tea leaves is coming in for the fresh process. The leaves of the first supply are now quickly removed out of the sun, by this time the fourth quantity will be brought in and is treated in the same rotation.

338. If the weather be excessively hot during the time that the leaves are exposed to the sun, the exposure might be reduced to 15, 10 or even 7 minutes, but with a cloudy sky the tossing must be increased up 5 to 6 instead of 3 times only; in this case only from 25 to 40 swinging motions is required instead of 40 to 50; a good deal depends upon quality and virtue of the leaves.

339. Before the leaves of the first batch are taken out of the sun and sent on to the *leaf-shed* a good smart tossing should be given to the trays or (tampiers). After that they are placed

in such a manner that the labourer can with ease continue the work of three or four batches.

The Leaf-sheds.

340. The tables should not be placed too near or too far from the boards or shelves, and the latter not too close together or near each other which would hinder the work.

341. Every rack must be numbered on the left hand post, commencing from the lower one upwards from 1 to 5, including the upper part of the rack which should show the running numbers of the shelves; for more trays than can be placed in 7 shelves it is not likely that there are leaves; as a rule 3 or 4 shelves are for fine leaf and for middle sorts sufficient; the man in charge should take them in due order, beginning with the lowest shelf.

342. When the trays are brought into the *Leaf-shed*, they should not be placed on the ground, and the use of the lower shelves must be absolutely prevented; the latter is necessary to avoid confusion and the former to protect the leaves from moisture and the dust of the ground.

343. For the *Pecco* or top-leaves double partitions should be carefully kept and the leaves not exposed to the wind, however for fine leaves and middle sorts, single partitions are more appropriate.

344. The cylinder should be placed perfectly level, and is chiefly used for the middle sorts when the sky is cloudy, but also during sunshine to quicken the withering of the leaves. The fine leaves are too delicate to undergo this process in the cylinder. Care should be taken that the door of the cylinder opens freely, and in a way that the leaves may fall out at once.

Work in the Leaf-sheds.

345. Even if two men are sufficient for the first treatment of the leaves four men should, nevertheless, be placed in the sheds, 3 men at the foot of racks and one man placed between the tables and the shelves; of these 3 men each one of them turn a tray with fine leaves and place them on the table before the one; the latter divides the contents of the 3 over 2 trays and after tossing the leaves heap them round on the sides so as to leave an opening in the mid-

dle, they are now placed upon the racks and remain there until the first batch which has come in is finished.

346. The trays (tampiers) with fine leaves which arrive with the second batch, are treated in the same manner as the first and always placed from the left in a row upon the shelves, the second row to commence to count from the last number of the first row.

347. Supposing the 3rd batch are middling leaves they should be treated in the same way as fine leaves, but placed on the fourth shelf from the left on the rack.

348. When the top leaves are brought in they should be well shaken, after that covered by another tray, but a slight opening left at one side before they are placed on the *Pecco* shelf rack.

349. As soon as the second course is commenced one additional man is required, 3 men continue the first treatment and two are required for the second course (*i. e.,*) one for the rack and one at the table.

350. The work of both men during the second treatment is to bring the leaves from the shelves and to give them a swinging turn round on the way, but they should be carefully replaced on the board in the same order with an opening left on the trays.

351. The second treatment with the middling leaves takes place immediately after the fine leaves; also the trays which gradually came in from the first stage have likewise their attention.

352. If new top leaves are brought in during the second stage of the work each is at first separately shaken and afterwards mixed together, after a tossing they are put away on the shelves as described before.

353. The *third* operation or treatment of the leaves takes place when they become withered, after being brought to the leaf-shed; this is judged of by the first 6 or 8 trays and it is of course essential that this should be looked after.

354. The most handy and skilled of the 5 workmen gives from time to time the top leaves, with the hands, a twist round on the tampiers; he ought to know the gradual stages of the leaves, and treat them accordingly softer or harder as required; this man should not be changed.

355. The turning over of the leaves with the hands is done by forming the hands hollow with the thumbs inwards, the leaves are taken up from below and shaken slowly over the hands but the process should not last longer than a minute, after which the leaves are put aside again.

356. The third operation with the top leaves consists first of being alternately shaken round on the tray or tampier, or turned over by hands perhaps 5 to 6 times, secondly an opening is made in the middle and then covered over by another bamboo tray or tampier and put away to stand for about an hour.

357. New top leaves when they are about half ready for this operation are treated in the same way, partly by shaking them in a swinging movement on the tampier or by turning them over with hands; there should be as large a quantity as possible on the tampier.

358. When the fine leaves have slightly withered the third operation is gone through in the same rotation as the second by beginning with the first tray or tampier.

359. In case the 9 trays with middling leaves are far behind the other work and two other kinds are ready, these 9 should be put into the cylinder and turned about whilst the 2 first kinds go through the third stage of the work.

360. Care must be taken not to mix any of the fine leaves with middling, or they get spoiled while the tossing is done and also later in the course of rolling.

361. The treatment of 9 tampiers or trays in the cylinder is done in the following manner, first two large trays are put on the ground, upon these two smaller ones are placed, of the usual size, the contents of 3 (out of the nine) is put at a time into the cylinder, the coverlid is shut and the cylinder is turned smartly from one side to another about three fourths round, occasionally a full turn round is given, afterwards the lid is opened and the cylinder turned so as to allow the leaves to slip gradually out, and not all at once, the contents is divided over two smaller trays, and an opening made in the middle; after that it is placed upon the shelves and the remainder treated in the same way and the contents of nine trays of leaves is thus divided over 6 tampiers.

362. The *fourth* operation commences with the first tray or

tampier of fine leaves, and as the leaves require now a quick and sharp treatment the work demands greater attention and should be done in two divisions.

363. Therefore the last arrived trays, which are supposed to consist of 4, one of fine and three of middling leaves, are put on the fourth and sixth shelf and in this way separated, whilst the other 20, with fine leaves, remain on the first and second shelf and 8 trays with middling leaves are on the 5th shelf, these 20 and 8 form the first division, and the last arrived 4 and 3 form the second division; all leaves which come later belong to the second division.

364. Commencing the fourth operation the trays with fine leaves are brought forward one by one, tossed over, and turned round by hand alternately on the tray;—the contents of 3 trays divided over two, an opening is made in the middle and replaced on the shelf, in this way the 20 trays of fine leaves are reduced to fourteen.

365. In the same manner the middling leaves of the first division are treated, but with this difference that the 6 trays of leaves which have come from the cylinder are turned over by the hand only, but the two others are going through the fourth operation as described by the finer leaves, and the number of the trays is in the same proportion altered from $1\frac{1}{2}$ to 1, the remainder is spread over the whole number of trays.

366. After this commences the second operation for the “fine” and “middling” leaves of the second division; but supposing that 5 more trays have arrived to the 6 mentioned before, the rule has of course to be slightly altered.

367. In the first division remain 3 men, and in the second 3 men at work; in the first division the fifth operation is commenced by turning the leaves of the different trays in rotation over with the hands. In the second division the fine and middling leaves go through the third operation, and the work is continued on the same footing as already described; by bringing the trays to and from the shelves they are kept in constant motion by the hands, so that they get ready for the *kwalis*.

368. The tossing of the leaves should always be continued in such a manner that if the work is once commenced with the *kwalis* it should not again be interrupted; should it be necessary to give a

little more time for the treatment of the leaves, which belong to the second division, and to reduce gradually the trays with leaves in the first, the cylinder is used for this purpose; it is better to do so in the beginning than at the end of the operation.

369. After the fourth operation of the leaves in the second division has been gone through several times, the fifth operation commences.

370. As soon as the leaves are fit for the *kwalie* the middle-tray in the first division is taken down from the board, the middling leaves follow in due course. The second division is treated in the same way, and as a general rule it is better to let them *wither* a little too much than not enough, only care should be taken, that the flavour does not escape, which will be the case if the leaves are placed too late in the *kwalie*.

371. During the time that the *kwalie* is worked the tossing of leaves in the leaf-shed is continued from the beginning of the first division to the end of the second, and although the trays gradually increase, the work must be resumed from the beginning.

372. There are now 60 trays with leaves in course of treatment in the leaf-shed which are reduced to 40 (vide § 365). By putting the leaves in the sun, about $\frac{3}{4}$ lb are placed on each *tray* or *tampier*, the whole quantity will cover thus 355 trays originally, as will be seen from the following *resumé*; first the contents of two trays are placed upon one i. e. 355 are reduced to 178, again two trays of leaves are put upon one which reduces the number to 89. The above two operations take place before the leaves come to the leaf-shed (vide § 337 and § 338 respectively). Afterwards the trays are reduced from 3 to 2 i. e. from 89 to 60 trays. This is done when they are brought into the leaf-shed (vide § 338) again the number of trays becomes reduced in the same proportion from 60 to 40, which takes place, during the tossing of the leaves in the leaf-shed (§ 346). Consequently it becomes easy enough to check the manufacture; as about $3\frac{3}{4}$ lbs leaves are necessary for 1 lb tea, the produce of tea should be proportionate to the leaves received.

Manufacturing place or Tea-house.

373. The manufacturing place might with careful plucking and

manufacturing be relieved of one of the 3 tables for assorting leaves, and also some benches might be removed, as there will be less picking required.

374. The fire under the first *Kwalie* should be lighted with dry wood an hour before the leaves come in.

375. Care must be taken to prevent the *Kwalies* from bursting as they are only and exclusively to be obtained from the province of Canton.

376. First one and later on the second *Kwalie* is getting at work; there ought to be 4 men for the first *Kwalie* viz: one *Kwalie* 2 rollers and one man who hands the leaves to the *Kwalier*; the latter must put the leaves in and out the *Kwalie*.

377. During the time of manufacture, the tea made the day before ought first be sifted; if there remain about 10 to 12 lbs upon the sieve from which the coarse leaves are picked out it is a sign that some where the work has been badly done.

The first Kwalier and Roller.

378. The manufacture commences with fine leaves, and middling leaves, each separate. No thermometer is used but merely practice and the feeling of the hand will indicate the necessary heat of the *kwalie*.

379. Each time from 1 $\frac{1}{2}$ to 2 lbs of leaves is put into the *Kwalie* by guessing; the leaves are kept in constant motion with both hands together, and to guard against burning some leaves remain under the fingers; to prevent the leaves from being scorched they must be kept in constant motion.

380 The heat of the *Kwalie* is bearable for the hands if quickly and nimbly done, but nevertheless performed with care and composure.

381. The main point in working the leaves in the first *Kwalie* consists in a skilful turning during the time they are passing over the hands.

382. During this process the leaves which accumulate and stick together are separated and loosened. Gradually the grassy smell disappears and a tea flavour emanates from the leaves; the leaves should now be kept close together, and as they become dryer and

the flavour becomes stronger a slight uplifting move with the hands is given, always well closed, which is performed by drawing the same backwards and turning them outwards; the leaves are now quickly upon the half tray.

383. The work in the first and second *Kwalie* is with "top", "fine", and "middling leaf" more or less the same but still more similar with the top and middling leaf; all should be to a certain degree dry before putting them into the *Kwalie*, but not too much; as they might break when rolled, and this is one of the main points to guard against.

384. The leaf supplier must always be quick to take the leaves from the *Kwalie*, and divide them between the two rollers, before they cool down.

385. The leaves of one *Kwalie* are sufficient for two rollers; these men are called the first rollers, each of them has his own tray or table to roll upon, and they take at once the whole contents of a *Kwalie* in hand.

386. The first rollers commence with 5 to 6 circular movements, and after that they describe a more oval movement accompanied by pressing and squeezing of the leaves; the work of rolling becomes gradually slower.

387. In the course of rolling the leaves assume gradually the tea flavour like during the *Kwalie* work it is therefore necessary to open the leaves after several rounds and to separate them to some extent, but they must be quickly closed again to prevent an escape of the flavour, which would happen if the leaves become cool.

388. When the work with the first *Kwalie* begins, the second *Kwalie* is taken on the fire, and heated.

389. The first rolling of the leaves being done quickly by keeping them close together and pressed between the hands they are several times rolled in a circular movement without stopping.

390. After this follows the rolling in an oblong direction or oval form about 50 to 60 times round with intermediate stopping to open the small clods.

391. The rolled leaves are now put on a tampier, small knots of leaves are separated, and mixed with the other; the tampier or

tray is now covered and placed for half an hour to one hour on the shelves; after that the work of the second *Kwalie* commences.

392. If with experienced workmen at the *Kwalie* and good rollers the work is finished in proper time; (the rolled leaves must not open again;) it may safely be supposed that the leaves have been plucked at the right time.

The Second Kwalier and Rollers.

393. With the commencement of the second *Kwalie* the workmen are thus divided; viz. one man continues sunning the leaves; three men are in the leaf-shed; two men for the *Kwalies*; four rollers and one supplier of leaves for both *Kwalies*, besides one man in the drying shed; altogether twelve men.

394. The furnaces or oven in the drying house are now warmed with some of the ashes left of the previous day; about 10 pounds of charcoal are required for each, and after this is ignited the fire is covered by the ashes left.

395. The second *kwalie* should not be as hot for the fine, and middling leaves as the first; the leaves are gradually and evenly heated and dried; the movements are the same as in the first *kwalie* only not as long as with the first *kwalie*.

396. The second rollers work in the same way as the first, but somewhat more in an oblong form and not so long.

397. The quantity of leaves put into the second *kwaile* should be what is required for two rollers; but the work is done more gently; they are occasionally turned, which separates the leaves, but they are immediately again kept together. As soon as the tea flavour, instead of a grassy smell, is noticed, a few finishing turns are given in a long roll, by leaning with the body forward, and then they are handed over to the rollers.

398. The second rollers have to look that none of the leaves stick in a lump or clod together, and during the oblong rolling on the table they have to take care that the leaves are not pressed flat or shaven; a dry basket must stand ready.

399. After this rolling the leaves are not again opened but they are pressed together in the shape of a ball, beaten to a flat cake and broken in two halves, these two halves are placed in the basket op-

posite to each other as they have been broken; the surface of the basket is thus covered with flat cakes; except a small space which remains open in the centre.

400. When the leaves are ready for the *kwalie* they have already shrunk to about two fifths of their natural size; they must now be quickly worked and, under some circumstances, both *kwalies* may be engaged at the same time for either the first or second *kwalie* work.

Top leaves, Kwaliers and Rollers.

401. The *kwalie* should be well cleaned before the work commences, especially with the top leaves, for which the first and second *kwalie* are generally used.

402. The first quality of *Pecco* ought to have a white greyish color and long rolled leaves of a downy appearance; the infused leaves show a light brown color, and the infusion itself a handsome brown color with a reddish tinge; to bring out these peculiarities it requires both a clever and dexterous *Kwalier* and Roller.

403. The quantity of top leaves put each time in the *kwalie* is sufficient for two rollers; the leaves are treated in the same way as the fine and middling leaves, also carefully rolled without squeezing, especially shoving should be avoided. When the edges of the leaves become stiff they are handed over to the rollers.

404. The rolling is done after placing them on the trays or tamper by a longitudinally move upwards and softly pressing them; this is 10 or 12 times repeated, and drawn back towards the person engaged. They are not opened out but placed on another tamper in rolls, covered over and sent to the drying shed.

405. As soon as the leaf-pluckers return from the garden, the tea of the previous day is assorted; 20 men are sufficient, relieving each other; one half of the number are plucking leaf while the other half is engaged in assorting the tea. Also the wages for plucking are paid at the same time, without loss of time or stopping of the work.

Drying House or Shed.

406. Out of the 12 furnaces nine are engaged, each kind is separately prepared; after a while, by putting the contents of two into one, four become available for the finishing firing where also the top leaves are prepared.

407. The ashes should be removed from the charcoal fire, and after the fires are well cleaned and the coals are thoroughly heated, a fresh layer of ashes is put over it.

408. With due care the tea should become neither burned nor scorched; the leaves contain but little moisture and the opening in the middle of the basket will prevent it; but if the charcoal is not good, or the fire smoky, the tea is liable to get spoiled in the above mentioned way.

The firing of fine and middling-leaves.

409. When the basket is placed on the fire to give the first firing to the leaves they are covered by a tampier, having a hand-broad opening on one side, and left there for 4 to 5 minutes, but as soon as the fume has a sweet flowery smell the basket is to be quickly removed.

410. The second basket should not be placed on the fire, before it is intended to remove the first, with an interval of time say from 4 to 5 minutes, to dry them in due proportion.

411. When a basket is removed each ball is opened one after the other and placed round the edge of the flat basket on the same spot again, but an open space remains in the middle; after that the basket is replaced on the fire.

412. Properly the fresh leaves have the first firing one day and the second firing next day, but the time for the first firing varies; the whole process of drying is actually divided in four parts.

413. With several drying basket under preparation it sometimes becomes necessary to change the usual routine; attention is paid to the vapour rising from one or the other, and to prepare those first, which appear doubtful and would suffer from delay.

414. Each basket, during the second drying or firing, must remain 4 to 5 minutes on the fire, but the same care must be exercised to prevent their getting scorched; the same as during the first firing.

415. Even when the basket is removed from the fire the tea may still get scorched if the half open and flat cakes are not quickly turned over with the hands.

416. The leaves are now brought towards one side of the basket

and well rubbed between the hands, the small clods are separated and the whole spread over a sieve or flat basket; a knock given to the basket will cause the dust to fall through the small apertures of the basket or leaves.

417 The fire is stirred up and covered as before with ashes, but the layer somewhat thicker and examined if clean before the basket is placed upon it; the latter is covered, only a small crevice of one finger breadth left open at one side.

418. For the third and fourth basket, now undergoing the first drying or firing, additional superintendence is required; one man employed in sunning the leaves and other two workmen ordered from the leaf-shed, will commence the work.

419. The baskets are placed upon the furnaces in due rotation as they were received from the rollers, separate for "fine" and "middling" leaves.

420. The heat for the third firing remains throughout the same until the tea is finished, it is rather less than used during the second firing. The firing should be gradual and the basket at intervals from 3 to 5 minutes be removed, which will enable the workman to make afterwards one basket of two, by putting the contents together.

421. Whenever the basket is removed from the fire, the tea is put on a heap, turned over, mixed and again spread out with an opening left on the middle; afterwards softly replaced over the fire.

422. As soon as the tea is half finished it should be mixed with another basket already in a like state of preparation.

423. The contents of two after being mixed together is undergoing the fourth firing for which one hour is generally sufficient, but sometimes it occupies even from 2 to 3 hours, in that case it has 2 to 3 times per hour to be removed and turned over, same as during the third firing.

424. As soon as the tea is sufficiently fired and dry enough, each kind is spread upon large tampiers, but protected from wind and draught, until the next day.

The supplementary drying or firing of the tea from the day previous.

425. By mixing 2 baskets or more in one during the process of

drying it should be arranged that always 4 to 5 furnaces remain free for the fresh leaves, and at least 4 furnaces remain available for the supplementary drying of the tea previously prepared.

426. First the fine, then the middling, and last the coarse leaves should be taken in hand; 6 pounds at a time in a basket and treated in the same manner as during the third drying. In the beginning the basket is removed every 3 minutes, by and by every 10 or 12 minutes and as often repeated, until the tea becomes now perfectly dry.

427. Tea thus dried is now heaped and prepared in the manner as described by the fourth firing; great care must however be taken to prevent it being scorched, and it must be protected from wind and drought during the time the leaves are getting cool.

428. With the top leaves great care is necessary on account of its delicacy; from half to $\frac{3}{4}$ lb. of tea should be carefully spread over the tampier leaving a small opening in the middle; then covered over and a small crevice left to allow the vapour to escape.

429. After 3 or 4 minutes the tampier is carefully removed, the tea lightly and speedily turned over and the basket in a like careful manner replaced on the furnace; this turning over is repeated until the tea is perfectly dry, and now the same attention as mentioned before is necessary when the tea is placed to cool down.

430. When the tea is nearly cooled down each description of leaves is put in clean and closed baskets or hampers which are placed on a table.

431. Before the fresh leaves come in the next morning two men or more are employed to carry these hampers to the packing or store room.

The drying or firing of the top leaves.

432. The fresh *Pecco* ought to be separately prepared, if possible last, for which 4 or more furnaces are available, after the second firing of the tea from the previous day has taken place.

433. The *Pecco* of one day's plucking should be divided over 5 baskets (or tampiers as before described) evenly spread out with an opening in the middle. In the beginning a basket is placed for about 2 minutes on the fire, and this is with intervals of 2 or 3 minutes repeated.

434. Whenever the basket is removed the tea is shuffled round, but the replacing and further preparation is done exactly the same way as with the *Pecco* at the first firing. The general routine is about as follows: a first drying, twice to be removed from the fire, after which about 5 minutes tossing and shaking upon the basket, and then the contents of the 5 baskets is divided over three; now 4 times to be taken off and at intervals about 3 minutes shuffling or shaking round on the basket.

435. The second drying: four times to be taken off and the contents of 3 baskets divided over two baskets: third drying: four times to be taken off 5 minutes shuffling and the 2 baskets are now put into one.

436. Fourth drying; four to six times to be taken off the fire, and 10 to 15 minutes shuffling; during this process more ashes should be put on the fire to diminish the heat.

437. As soon as the *Pecco* is half dry the contents are placed on a flat basket or tampier and placed to cool down without the influence of wind. It is kept covered over until the next day when the after drying takes place or drought.

438. In making black tea the planter has to consider chiefly; time and quantity, a detailed example has been given; he must try to get 4 standard qualities made at his own factory and under his own superintendence.

439. The time for meals during the manufacturing season should be regulated by the planter; if irregular it not seldom happens that the work is hurried towards the end and the tea spoiled.

440. A review of the days work will convince the planter if the men employed at the factory are acquainted with their work; it is easier and simpler than all instructions, and requires only attention on his part.

CHAPTER XX.

Manufacture of Green Tea.

441. The manufacture of green tea resembles in 26 processes the proceedings described in the previous chapters on black tea. These are fully particularized and therefore not repeated here.

Kwaliers and Rollers.

442. Although thus passing over the subject it should still be remembered that the leaves on arrival from the garden were brought in a perfectly dry state, before they get a reddish tinge, also that the *kwalies*, and tables for rolling, as well as the hands of the rollers, are washed and clean. In the beginning 4 men are employed at the first *kwalie*, the 1st, 2nd, 3rd and 4th *kwalies* are heated with fire wood, 2 lbs of leaves placed in each *kwalie*.

443. The leaves are quicker turned round than is the case of manufacture with black tea; they should not be quashed but 30 to 40 times in a minute lightly and quickly turned over in the *kwalie* and after 1 or 2 minutes they are ready for the first roller.

444. As the leaves are given to the roller, the fire is lighted under the second *flat kwalie*, and a bucket of water with a sieve is placed in readiness near the roller.

445. The first rolling commences in form of a circle gradually more oval, also longitudinally, but without quashing them. The quantity is divided into three parts and each portion strongly pressed, then loosened, and the small clumps separated; the rolling is repeated until in a fit state for the second roller.

446. The second rollers have to loosen the small clumps without opening up the leaves themselves, and pass them quickly unto the 2nd *kwalier*, who works them on a *flat kwalie*, in the meantime a sloping *kwalie* is prepared.

447. The work at the second *kwalie* is the same as in the first, but slower and sedately, and as the leaves become dryer they are handed over to the 2nd rollers.

448. The second rolling is done in the same manner as the first, but without much pressing, only the small clumps are opened up, and after some rolling the leaves are now passed on to the 3rd *kwalier*.

449. The 3rd *kwalier* works at once the leaves of 4 rounds from the 2nd roller until he receives them, he opens the small clump of what he has on hand, without detriment to the twist of the leaves; he must endeavour to get the leaves speedily dry or they assume a yellowish, brownish and light color.

450. The fourth *kwalie* is now immediately put in readiness,

heated to the same degree as the 3rd; the 4th *kwalier*, on getting his supply of leaves, proceeds with his work in the same manner as the 3rd *kwalier*.

451. The 3rd and 4th *kwaliers* work upwards and a little over towards the right side of the *kwalie*; after 10 to 12 minutes the leaves become dryer and assume a darker appearance; the rolling is altered in another direction.

452. The *kwalier* commences now with the right hand, and working towards the left side of the *upwards sloping kwalie*, first slowly, gradually quickening the work until the tea assumes a blue greenish tinge when he quickens the motion to about 15 to 20 times round in a minute, which is continued for 8 to 10 minutes, after that the tea is made over to the 5th *kwalier*.

453. The 5th *kwalie* has been heated with charcoal and the man works at one time the contents of $2\frac{1}{2}$ *kwalies* which were made over to him by the 3rd and 4th *kwalier*. As soon as the 3rd and 4th *kwaliers* have finished their work, they put likewise a charcoal fire, under their *kwalie* and help the 5th *kwalier*.

454. The work of the 5th *kwalier* is the same: with one half the contents of both the 3rd and 4th *kwalie* he is constantly changing his motions from right to left and left to right, but quicker, say about 20 and 25 times in a minute and continues this for a quarter of an hour.

455. The *kwalier* increases this motion to 35 to 40 times round in a minute without stopping, but not more, this he has to continue for about half an hour, and now the tea assumes a fresh green color and has become perfectly dry.

456. The manufacture is the same with "middling" and "fine leaves." Two men who are now available pass the tea of the previous day through a sieve and weigh the fresh leaves which have come in from the garden, they also clean the tampiers and *kwalies*.

Superintendence and precaution.

457. If the first *kwalier* is a pushing and strong man, he can undertake to work 8 to 4 lbs at once, but should the other men not be of the same bodily strength, the progress of the work will slacken, and the leaves may easily get spoiled. The planter should therefore

see that he can depend upon the other tea-makers to continue the work before he allows the first man to commence with such a quantity.

458. If the first leaves are brought at about 8 o'clock in the morning and the supply continues to arrive at regular intervals a good manufacturer will finish the work in good time; during the day, 9 men will have finished their work by 2 o'clock, and 3 men more by 4 o'clock; however the drying of the tea manufactured the previous day, will delay the entire work being finished before 6 o'clock in the afternoon.

459. These 9 men having done with their work at rather an early hour of the day, may change by rotation with the 3rd, 4th and 5th *kwaliers*; this will facilitate the working, but not actually save time, although it will help to get the work of the 3rd and 4th *kwaliers* done sooner, but the 5th *kwalier* will not have finished earlier.

460. The 1st and 2nd *kwaliers* can gain a great deal of time in case the first commences with $1\frac{1}{2}$ lbs of leaves, and the force and activity which he is able to use, may enable him to increase it to 3 to 4 lbs, which will greatly speed the work; but judging of the relative strength of the different workmen the rollers should be chiefly taken into consideration, very few of them are able to work such a quantity of leaves at a proportionate time.

461. With diligent and regular workmen the manufacturing work, including the second drying or firing, of the previous day's tea, might be finished by 4 o'clock in the afternoon; should the quality of tea prove to be inferior, the fault is with the plucking, perhaps in having commenced a few days too early.

462. Towards noon the *kwalies*, roll-tampiers, and the hands of the rollers should be washed or the tea may suffer from the sticking of the juice; and if there is still some of the juice noticed, when the leaves are spread, it ought to be removed to prevent any injury to the quality of the tea.

463. The sifters should have sieves of good material, in order to judge of the quality of tea; if there remains on the top of the sieve about 12 lbs it is rather too much, and caused in some way by the 3rd and 4th *kwaliers*.

464. If among the dried fine leaves a large quantity of small curled broken leaves are found, as well as broken, and dust, the fault is by not having the top leaves carefully separated at the time of plucking.

465. Each day's manufacture should be carefully examined, and sorted, if this is neglected, the work altogether is getting in disorder, and the quality of the tea suffers.

Top leaves, Kwaliers and Rollers.

466. For "top-leaves" the 1st, 2nd and 5th *kwalie* is used, and instead of the 3rd and 4th *kwalie*, a flat basket or hamper and a carrying basket will be used. The *kwaliers* and rollers work, as already mentioned in the preceeding chapters under the head of "fine" and "middling leaves." A bucket of water, and a sieve should always be close at hand.

467. The first rollers, after rolling the leaves firmly in a small circular round, press them and throw 5 or 6 times water over them; when the water has run off they are again squeezed, rolled over, and squeezed again, and now again 15 to 20 times firmly rolled.

468. The 2nd rollers will not pick the large *knobs* out, and the 2nd *kwaliers* have to work the leaves until they become half dry and sticky enough to form them into close bolls.

469. The 2nd rollers now commence rolling them in a firm and circular form, press them hard together, and to form close balls of about $2\frac{1}{2}$ thumb average size which is called *Toosjes*.

470. This latter work is done by 2 men of those employed with sifting, who change or are alternately relieved by 2 men of the leaf pluckers; if all manufacturers can be engaged in this work the better it will be for the quality of the tea.

471. *Joosjes* are made by twisting the hands in a peculiar way, when a good granular form of the leaf is obtained in less than a second, which looks like the knot in a string with projecting points but not of longitudinal or flat shape.

472. A good practised twister will make it in one time with few points protuding, these points are liable to break off in the course of the swinging motion (or the *slingern*) on the sieve, and when sifting of the tea is done this ought to be put with *fannings*.

473. "Joosjes" which are long under preparation will get blackish, or of dullish color, sometimes even of a greenish hue, but more frequently entirely round, smooth and of large size.

474. It is necessary for the first firing of the Joosjes immediately after the manufacture that they are thinly spread upon a sieve which is previously covered with blotting paper, and then placed over a flat *kwalie* in a drying basket, which remains open; from time to time the contents upon the sieve is carefully turned over, and as soon as the leaves are half dry they should be removed.

475. All Joosjes obtained in course of the day should be worked on an oblique *kwalie* until they become perfectly dry, so that they may be worked in the 5th *kwalie* from 1 to $1\frac{1}{4}$ hour without stopping.

476. Joosjes consist of large and small granular knobs* which through sifting become separated from each other; it is better of course if each manufacturer would keep the korrels of coarse leaf separate from the korrels of fine leaf, the preparation should be say 1 to 3, the first firing being given to those where the points are much protruding and which have the character of fanning and chaff.

477. Steam of boiling water should neither be used for Joosjes nor for other kinds of green tea, it proves as far as experience goes injurious to the quality of tea.

Assorting and subsequent drying.

478. The people engaged in plucking should be paid immediately on return from the garden, and then there will be spare time for them to pick the yellow and loose rolled leaves, as well as the knots out of the tea manufactured the day previous.

479. The second firing or last drying of the tea from the day previous commences as soon as the 3rd and 4th *kwalie* is disengaged, later on the 5th is likewise added; each *kwalie* takes 6th at a time, the process is the same as that of the 5th *kwalie* working the fresh leaves; it will last from $\frac{3}{4}$ to one hour with fine weather, and from 1 to $1\frac{1}{4}$ hour during rainy and damp weather. As soon as the tea is

* Korrels or granular knobs.

well dried, each kind is placed in a closed and locked hamper placed on a table, and brought the next day to the packing room.

480. In the manufacturing building or tea-house there should always be a bucket with cement ready for use, and every evening before the tea-maker leaves the building he should look if any of the masonry work on the sloping *kwalie* has suffered, that it may be at once repaired.

CHAPTER XXI.

Usual assortment of the different qualities of tea.

481. In some parts of China the rolling of black and green tea is done by feet instead of by hands, they are able to use more force with their feet than with their hands, and in the lower provinces it is always done, but in the upper provinces chiefly after long continued rains, more especially with "middling leaves" when they have become a little decomposed.

482. The difference with this as regard the usual way of manufacturing consists only in the way of rolling: 8 rollers are placed near one *kwalie* which contains 2 lbs at one time, they stand in a row and within 4 minutes they have rolled about 8 lbs of leaves.

483. Besides this mode of manufacturing is cheaper than working by hand and has in consequence been adopted in many district of China; however in *Java* this mode of manufacture has never been introduced.

484. Occasionally and purposely tea is made of an entire brownish tint, called "Henngmoey" and obtained by a preliminary sunning of the leaves during which time they are kept in motion, after that they are left for one or two hours in the sun, nearly totally covered, except a small crevice, during this period they are occasionally turned over with the hands, like *Pecco*; in other respects the usual mode of manufacture is adopted; it is a kind of Congo, and some tea bushes of particular nature are especially adapted for this sort called "Henngmoey."

485. Sometimes a certain quality of tea is improved by mixing after the usual process of drying has been finished, and during the latter part of drying 4 to 5 ounces on a sieve of a better kind swinging it round it is made to come into one heap. 72 lbs of tea would require 16,000 of such turns; however this sort of general

way to get one quality is injurious and an honest planter should not introduce it.

486. In some districts the decomposed leaves are especially prepared and principally used for green tea, this is done in coarse, close and strong linen bags, but rather hard; 12 to 15 lbs are put into a bag being previously rolled, and requires now one and half hour's working; gradually it gets into shape of a close ball which is taken out of the bag and dried or fired in the usual way; often these balls are not opened but sold in this shape, but not at Canton.

CHAPTER XXII.

Means of proving the quality of Tea.

488. In each Tea-house should be kept 4 cups with covers for testing the different kinds of tea of the previous day's manufacture; in each cup half a dram is placed, and infused with boiling water, which is allowed to stand for 5 to 8 minutes.

489. The overseer judges of the tea chiefly from the color of the infusion and of the wet leaves; he must look that, among the black tea there are no jet-black, crumpled or dead brownish leaves, and among the green tea no yellow, crumpled and faded greenish leaves.

490. The planter should be able to judge by the taste of the quality of tea just like those engaged in the trade, and likewise instruct his overseer on this point.

491. The planter to be sure of his test and to check his judgment should send samples and keep counter samples, with a descriptive list, to well known testers and request their filling up the blank form with a description of the infusion, the infused as well as dried leaves.

492. The sample should be packed in small paper bags and again in the same way put up together in a parcel; tied up, but not pasted with starch.

493. On receipt of the list noting the different qualities of tea; the planter will have to test them in the same manner as is usually done by the trade.

494. Also the comparison and description of the samples, should be done in the same way as is customary by trade with reference to the appearance and taste as well as other particulars. On the

whole the preparations should be done with exactness and cleanliness.

CHAPTER XXIII.

The receipt and despatch of the Tea.

495. The ware-house book should be so arranged as to contain separate columns for receipt and despatch, opposite to each other; the first with 8 and the other with 12 divisions; each factory has its own division.

496. As soon as the tea arrives from a factory it is at once received, each kind weighed and stored in the large box or place reserved for this kind, and a receipt is given. The tea not well picked should be turned to the out factory.

497. Whenever the columns of the ware-house book indicate that there is sufficient tea collected for packing, the work should be taken in hand at once, each factory separately.

498. The tea should be well packed but not stamped into the boxes, sufficiently compact however as not to shake together from the jolting when transported by coolies or otherwise; there should not be two kinds of tea of 2 different pluckings or of 2 factories in the same box or the same hamper.

499. All boxes as well as the hampers should be well aired and perfectly dry before any tea is put into them.

500. To place the boxes in the hamper for packing it is necessary that the packing men cause a basket work of reed to be made round the box which is left open and protruding at the top.

501. Whenever a box has been filled from the hamper, it is entered in the ware-house book on the side opposite for the delivery; and when they are despatched the numbers are counted and the weight written off. The boxes should be uniformly marked.

502. The teas should be quickly despatched, say, about 10 or 12 hampers of boxes at a time, in order to get them out of the moist atmosphere of the plantations; with each, a copy of the packing-house or ware-house book is forwarded, in the shape of an invoice.

CHAPTER XXIV.

Favorable results of tea cultivation.

503. For the planter as well as for the people the cultivation of tea is an agreeable, and at the same time neat and clean work.

With order, judgment and good directions as well as proper use of the labor on hand: the plucking at proper time, and the paying of wages by "*tyams*", not too greedy for a day's work. The work of the women and children should be encouraged by pay and not too cheap a price be given for the produce; all this together duly observed will make it an easy and profitable thing and the work will prove favorable.

504. It will prove remunerative on account of what the tea actually costs to produce and with quick workmen according to our scale the cost of the produce will be about 40 fl. $\frac{1}{2}$ 100 lb;* and if the people engaged in plucking are well drilled in the work might be done for 35 fl.; with "*Deesas*" labor the price comes to about the same; sometimes 5 fls higher.

505. Still more favorable for the cultivation are the results really obtained, which show that the charges for the whole work, including the cost for boxes, as soon as the crop is sufficiently large, to amount to a few millions pounds of tea, the charges will not be more than 15 cents $\frac{1}{2}$ lb.†

506. Above all the most favorable result will be felt a few years hence when Java tea, which is not like many of the China kinds mixed with flowers, herbs or injurious mineral colors, shall find every where a sale; when shipping and trade will still more flourish by it, and the enterprising capitalist, who yearly exports 30 to 40 millions of pounds of this produce, will meet his reward by hundred millions of florins.

* 40 florins per 100 lb equal to about 5 annas per lb English.

† Equal to about 2 annas per lb English.

NOTE.—It has been difficult for the Translator to find corresponding technical words for some of the terms used in the original work, where many Javanese expressions have crept in; but no doubt the practical Planter for whom this work will be of special interest, will have no difficulty in guessing the meaning of its Author. In translating it, the object has been to give as much as possible a literal version of each paragraph, and although many things might be deemed superfluous and of too much detail, still it must be borne in mind that this book was written fully twenty years ago, when very few Europeans had been able to collect particulars concerning the manufacture of tea, and when even the smallest item illustrative of the working of it proved of great value for the introduction of tea cultivation into other countries.—H. R.

The Sub-Siwalik Tract with especial reference to the Bijnour Forest and its trees, and an account of their useful Products.
 By JOHN LINDSAY STEWART, M. D. *Civil Surgeon, Bijnour.*

Along great part of the base of the Himalaya may be observed two characteristic features, viz : a lower ridge or ridges of geologically more recent formation than the inner mountains ; and a belt of thick forest, the plants of which mostly differ from those both of the plains outside and of the hills above it. These are however coincident in a portion of their extent only, the position of the former as a whole being considerably to the westward of the latter.

As my purpose in this paper is to discuss more particularly a part of the Sub-Himalayan forest I may dismiss with a very few observations what has been variously called the tertiary belt, the Sub-Himalayan, and the Siwalik range. The two first names need no explanation, the last is derived from the Sanscrit, meaning "the world or place of Siva" who married Gauri or Parwati whose father was Himala the lord of the great snowy range.

This formation appears to be traceable from the upper Punjab to Jelpigoree below Darjeeling, and the extent of its development varies greatly within these limits, but on the whole appears to increase as we pass westward. Thus the narrow belt of sandstone which below Darjeeling peeps out from under the clayslate at the base of the hills, at various points between the Sardah and the Kavee becomes developed into the Siwalik range reaching from a few hundred feet as near Kalka, to 3,000 feet above the sea as between the Ganges and Jumna, and often separated from the Himalaya proper by the valleys locally called Doons. Of these the Patlee Doon between the Sardah and Ganges, the Dehra Doon extending from the latter to the Jumna, and the Kangra valley, between the Beas and Ravee, may be taken as prominent examples.

Westward of the last again in Jumna (where Thomson states the Siwalik sandstone to be at least 30 miles in width) and Rajaware we find the Siwalik system as it were flattened out, there being in many places no less than a triple range of Doon like valleys, divided from each other and the plains by low, arid, tertiary ridges. And just as these multiple Doons are foreshadowed to the eastward, in the little valleys external and parallel to that of Kangra, so on the Nepal Frontier we are told that the existence of a longitudinal series of small Doons is indicated, though the term is there unknown.

The Sub-Siwalik belt of Forest, with the products more particularly of a part of which, *viz*: the Bijnour forest, I am at present concerned, requires more elaborate notice. And as the whole subject is one of some interest, I may be excused for discussing at some length, the nature, peculiarities and extent of especially that portion of it which lies between the rivers Sardah and Ganges, the western segment of which is included in the district of Bijnour.

The concurrent observations of many travellers assure us that this belt extends from Sudduya at the head of the Assam valley to the point where the Jumna debouches from the mountains,—varying it is true in luxuriance and breadth, but presenting a remarkable uniformity in its Flora from the Jumna to (at least) Gawalpara on the east. In the Assam valley the Flora becomes more tropical in character; while westward of the Jumna, the forest, which has already between the Ganges and that river begun to get less luxuriant, gradually diminishes until near Roopar on the Sutlej, we find from the writings of Griffith and Thomson that only a few trees, stray members of the Flora of the eastern part of this belt, continue to maintain a struggling existence. Indeed the former writer compares its appearance and vegetation near the Sutlej to those by the Sind-Sagar Doab Salt Range in the Punjab, a comparison which could only be justified by great paucity of trees and verdure generally.

Opposite the Kangra valley and further west, parallel to Rajawari, there is no longer even a vestige of forest, but the scraggy shrubs of the plains come close up to the base of, and many ascend to some distance on the outer sandstone ranges.

I may here note that the eastern vegetation extends further to the west on and inside the latter than it does at their base : for parallel to Kangra inside these ranges, grow the marking nut (*Semecarpus anacardium*), Bamboo, and several other trees, none of which I found so far west as Bhimber and Rajawari, so that this must be near their western limit. The Bamboo however is stated to grow in the Punjab Salt Range, and Dr. Jameson in a recent report mentions having observed it north-west of Rawul Pindia.

The name Tarai, or Tariyani by which this belt or part of it is commonly known, is evidently derived from the Persian *tar*, moist. An ingenious philologist (Madden) suggests its being derived from the sanscrit *tale*, below, but this idea probably arose from the assertion of some *pahari* willing to arrogate for his mountain ancestors the honour of having first given a name to the tract. By local authorities I have been informed that this name first originated about 110 years ago when Diwan Siroman by constructing irrigation-canals dammed up the water outside of them and thus caused the production of many swamps. This story however appears undeserving of any attention in so far as the origin of the term is concerned.

But the name Tarai is by no means of universal application in either the length or breadth of this belt. Indeed, strictly speaking, it seems to have been applied by natives to the swampy tract outside the Forest proper, and to that only opposite Kumaon. 'Abreast of Nepal the forest belt is called *Morung*, and so far as my enquiries go the word *Tarai* is unknown to the natives east of the Nepal frontier. Again to the westward of Kumaon, in the Bijnour district, it is known by no name but the generic one of *ban* or jungle. It would thus

appear that we Europeans, taking as usual a more extensive view of physical facts than natives generally do, and wishing to have a convenient name for a feature stretching over a wide extent of country, and known by different names in various parts of its range, adopted the name of a part for the whole. In the same way the terms Himalaya and Siwalik have got from us a much more extended application than those who for ages used them could have dreamed of.

Throughout this paper I shall, when referring to the tract generally, use the terms Forest belt or sub-Siwalik tract, as being less likely to lead to confusion than the word Tarai and shall when necessary distinguish the inner and outer parts of it as Forest proper and Tarai proper.

It has been truly said by Hooker that geographically this tract belongs to the plains, and politically to the hills, while geologically and botanically it appertains to neither; and the Sanscrit *mudh-des*, middle-country; said to be occasionally applied to it by Kumaonees, expresses a similar idea. It has had more attention directed to its peculiarities between the Sardah and Ganges, i. e., in Rohilkhund, than in any other part of its extent, and the list of observers who have written on these points from the commencement of the century onwards, and whose observations I have been able to consult, includes the names of Herbert, Traill, Strachey, Jones and Batten. The few remarks made by other writers on the physical structure and vegetable productions of other parts of the tract, appear to be quite in accordance, *mutatis mutandis*, with the facts known with regard to these points and the theoretical reasons assigned for them as to this portion of it.

The width of the Forest-belt varies greatly in different parts, and some of those who have written respecting the western portions of it have used somewhat careless expressions which would lead one to suppose that the further East, indefinitely, the broader and denser it becomes. But this appears to be by no means the case, so far as various observers have given us

figures on the subject. I can find no definite statement as to its extent to the east of Sikkim, but Hooker mentions expressly that there it ranges from 8 to 12 miles in width; Kirkpatrick and Hoffmeister coincide in making its breadth opposite Nepal about 10 or 12 miles, and between the Sardah and Ganges it ranges from 20 to 30 miles in breadth opposite part of Kumaon, where in all its features it probably attains its maximum development to an average of 6 or 7 abreast of Gurhwal. To the westward of the Ganges, as has been mentioned, it rapidly diminishes in width and density, and finally gradually disappears beyond the Jumna.

The Forest-belt is conspicuously and notably divided into two very different zones which require separate attention. The first and wider of these, skirting the edge of the lower hills is that of dry Forest, the breadth of which in Rohilkhund, ranges from 5 to 20 miles. This is called (*bhabar* or *ookhar bhomee*, dry country) below Kumaon, and *ban* elsewhere. It is distinguished by an almost total absence of surface water, a soil or sub-soil of shingle stretching to an immense depth, and an abundant growth of forest trees, large shrubs and grasses with a comparative scarcity of undergrowth.

The second zone constitutes the Tarai proper which lies immediately outside the former, and between the Sardah and Ganges ranges from 1 to 10 miles in breadth. This zone is marked by a profusion of grass jungle, deep vegetable or clayey soil, and an abundance of moisture, in the shape of swamps, spring-heads oozing from the surface and streams. Some of these last originate in the swamps, while the water of many only re-appears after having been absorbed in the thirsty gravel-beds of the forest, soon after their exit from the hills.

The distinctive marks of these two zones of this tract appear to be clearly observable for many hundred miles to the eastward of the Sardah, and it becomes an interesting question to decide the rationale of their existence. This seems to have been made out with considerable clearness and to be supported

by all recorded evidence from observation that has been brought to bear upon it. At first sight it would appear as if the Tarai proper were caused by a sudden dip in the ground tending to make all water get dammed up in that line. But neither is this view confirmed by levelling, nor, if it were so, would it account for all the facts of the case, in especial the immense *amount* of water which there appears, or re-appears, as the case may be, on and near the surface. Levelling has shown that the dry forest slopes from the edge of the hills at first very rapidly and then more gradually downwards to the inner edge of the Tarai proper; wells have been sunk to very great depths (at one place it is said to 150 and at another to 300 feet) in the shingle-beds under-lying the forest, without reaching their limits or getting water; and beds of red clay similar to what are remarked in many places where the forest touches the hills appear along the line of springs at the inner edge of the Tarai. (Similar clay strata are said to constitute the sub-soil under the vegetable mould &c. in many parts of the plain of Rohilkhund.) These facts and the phenomena of both dry and moist zones lead to the belief that the shingle strata under the forest are of the nature of a mighty talus, beneath the whole width of which stretch these clay-beds again to appear outside at the Tarai bringing with them the water which has soaked into the former from streams or ordinary drainage in the rains. These shingle-beds extend furthest along the line of the rivers, and in Rohilkhund appear to be much deeper in certain places remote from both Sardah and Ganges than near either of these rivers. In both Tula-dis on the former, and Chandee on the latter, water can in some localities be reached by sinking wells of moderate depth. This thinning off of the strata of gravel towards the boundary rivers coincides with what has been observed in the Dehra Doon. These analogous gravel and boulder beds slope from the Himalaya towards the Siwaliks, and near the centre of the valley (from east to west) are, at Dehra 220 feet thick and at

one place water could not be reached at 250 feet, while these strata are known to become much thinner towards either river.

Any geological theory involving the existence of an immense ocean covering in all probability, at least great part of the Gangetic plain at a time anterior to the plain itself as well as the mountains to the north of it having attained their present altitude, which will account for the formation of the talus outside the Siwaliks will equally explain the existence of the gravel beds in the Doons within them, and the thinning off of both towards their boundary rivers would be effected by similar causes.

Of changes in the relative heights of portions of the forest belt within the period since it has been inhabited I can find no evidence, except that (as mentioned by Royle) at one place between the Ganges, and Jumna, Cautley discovered the remains of a buried town 17 feet below the present surface of the country, with Indo-Bactrian coins referrible to the commencement of our era. He considered this to have been caused by the constant washing down of detritus from the lower hills, with—which appears more doubtful,—the gradual accumulation of sand in particular places from the action of the wind.

The slope of the dry forest from the hills is too slight to be conspicuous, nor is there in the Rohilkhund forest much appearance of the terracing which Hooker mentions as prevailing throughout the breadth of the Sikkim part of this belt. Here the general surface is in most places tolerably even or gently undulating except where cut up by the beds of streams; but in some parts, mostly near the edge of the hills, the surface is marked by as it were large furrows with alternating ridges, both running at nearly right angles to the latter.

The aridity of the surface of the whole of the forest proper is very great, and in Rohilkhund apparently even more so than in some places to the east, as now in many parts there is not a drop of water for miles, all except the larger streams.

disappearing within a very short distance of the edge of the hills.

The ground in many places has little or no covering of soil while in some parts the latter varies from 2 or 3 inches to a couple of feet or more in depth and consists generally of a sandy mould, being richer in depressed spots than elsewhere. At both the Siwalik and Tarai edges a rich mould predominates.

As has been mentioned, the Tarāi proper is characterized by abundance of moisture often forming extensive swamps, and by luxuriant herbaceous vegetation consisting in great part of gigantic grasses and marsh-plants. This wet belt appears to be best developed opposite Kumaon, but is abundantly traceable at least to the Ganges, by a series of swamps which run into the Khādir land on the eastern bank of that river. This state of things, as has been stated above, depends upon no true depression of the surface, although it is aggravated and to some extent caused by the drainage slope being here insufficient to carry off the water which has risen to the surface from between the gravel and the clay. Jones ("Rohilkhund canals,") mentions some instances when this has been increased, and one where miles of marsh had been created by irrigation-canals obstructing the out flow of the surface-water.

Two principal circumstances may be considered as materially affecting the climate of the whole of the Sub-Siwalik tract, one being its proximity to the hills, and the other, the existence over the whole of it, for great part of the year, of very dense vegetation.

The only important fact regarding the temperature and the tract with which I am acquainted, is that, as mentioned by Hooker, the average temperature in the Sikkim Tarāi, is in spring as compared with Calcutta, by several degrees colder than the increased latitude will account for, and this is probably to some extent true of the whole tract.

The influence exercised by the neighbourhood of the hills is chiefly shewn in an increased amount of rain fall over what occurs at places even a short distance further from the mountains. This results from the fact that in the rainy season, the S. W. monsoon when deflected from its original to a North Westerly course by the Himalaya, besides pouring forth its waters in greater profusion than elsewhere on the outer ranges of the latter, brings an increased supply of rain to their skirts. From the circumstance of all the Police and other posts in the forests being abandoned during the rains, I am prevented from giving any statistics of the amount of rain in the Bijnour Forest, but so great is the influence I here allude to, that the difference of rain-fall at Nujeebabad, 12 miles distant from the Siwāliks and just outside the forest tract, and at Bijnour, 18 miles further from them, is very considerable. The following are the figures for the last 2½ years:—

Amount of Rain in inches.

	1861.	1862.	Jany. June, 1863.	Total in two and a half years.
Nujeebabad,	34.93	65.9	18.2	119.03
Bijnour, ...	28.85	44.2	8.1	81.15

This may serve to indicate how much more rain falls along the forest tract than in the open plains outside.

The causative relations of humidity and vegetation towards each other are as yet by no means clearly understood, for although it is abundantly evident that a larger amount of moisture in the earth and air during the season of growth, increases vegetative power very greatly, it is not certain how and to what extent the results of the latter re-act on the former. The dogma is popularly accepted that the presence of forests will invariably increase the amount of rain fall in any given

district, and even the natives in some parts of India (see Butter's Topography of Oudh) would appear to hold a similar doctrine. In such a belief there is reason to think that cause and effect are confused, and although it is very clear how forests can by preventing evaporation and rapid running off of rain after it has fallen help very materially in the retention of moisture, I am not aware of any definite facts of importance being adduced on skilled authority, to prove the larger proposition.

With regard to dew this much is certain that more of it forms on leaves than on the bare ground; consequently the amount of dew in the forest is much larger than that on the open plain; and during the comparatively rainless cold season, the heavy dews of the former are much longer retained owing to the abundance in grass, scrub, and trees. In accordance with a well-known law regulating dew fall also, I have observed that the quantity of dew is very much greater within about half a mile of the base of the Siwāliks than in other parts of the forest; indeed the dew in December is heavier there than I have ever seen elsewhere.

As will be afterwards shewn, the great humidity of this tract has a very stimulant effect on the growth of plants, and even a mile or two outside the forest, the quantity of young trees and shrubs that spring up in orchards and in similar situations is much greater than that observed a few miles further in the plains. Another phenomenon indicating the greater amount of atmospheric moisture near the hills, is that even at Nujeebabad, 12 miles in a direct line from them and quite outside the forest, numerous strong root-stems are often thrown out by the *bargad* (*Ficus Indica*), though this but seldom happens to any marked extent except over water 18 miles further from the Siwāliks.

Deferring for a little the special effects that the peculiarities of climate in the forest belt have on its vegetation, I may now proceed to describe shortly the Bijour Forest, premising

that in most points of physical structure &c. it agrees with the general description that has been given of the whole belt. This then, constitutes the western portion of the Rohilkhund Forest, and is contained in a strip of varying breadth forming the Northern portion of the zillah of Bijnour, which is here conterminous with the mountain district of Gurhwāl along the outer edge of this part of the Siwāliks. The boundary to the West is the first few miles of the extra-Himalayan course of the Ganges by which this is separated from the Saharunpore district, and to the East is the Phika naddi between Bijnour and Moradabad districts.

This strip is about 60 miles long and its average breadth may be stated at 6 miles, as, although in some places it extends to 10 miles from the base of the Siwāliks, yet in others it is very much narrower than this,—and notably on the course of the Khop naddi, up which cultivation has readily crept, it is at one place not much over a mile in width. Its general direction, coinciding with that of this part of the Siwāliks, is nearly N. N. W. and S. S. E. and it contains, in round numbers 260,000 acres, or more than 360 square miles.

The largest stream is the Rāmgunga which, issuing from the Patlee Doon crosses the eastern part of this belt; there are besides only two or three other streams of any moment. These are the Knoch, which issues from the hills at Koldwāra, and being joined by the Sanei from the Kothli Doon crosses the forest about its centre, and the Mālin some miles to the westward of this. A multitude of small *Raos* occur throughout the belt, and although some of them supply small irrigation canals at their debouchement from the Siwāliks ere the thirsty sub-soil has had time to swallow up their little streams, they are by no means perennial, but within the forest proper they seem in general only to carry off drainage water in the rainy season, and throughout great part of the year exist only as broad gravelly beds furrowing the surface in directions more or less at right angles to the course of the Siwāliks.

One chief cause of the irregularity in width of the portion of this belt which is covered with trees or jungle is the existence or availability of water for irrigation which, especially on the Ramgunga and Khop caused the cultivated portion of the district to encroach very considerably on this belt, so that when seen from above it seems that along the course of each of these streams there is a large indentation in the forest. This appearance however is partly accounted for by the circumstance that while along these streams the gravelly sub-soil is probably shallower than elsewhere, the soil is then certainly less arid, richer, and better suited for the growth of grasses than of trees, indeed approaches the better parts of the Khādir of the Ganges in character.

When viewed from the Siwāliks above, the forest has a verdant and so far pleasing, but at the same time a monotonous effect, which proceeds chiefly from the too great evenness of the surface, and the want of water. To these is to be added the sameness of colour, as the tints of the mass of trees when embraced in a general view, become blended into one. This is only varied by such accidents as the lighter green patches of *śāl*, and the more conspicuous single trees such as the magnificent *haldū* whose foliage seems light green amid the general dull tint of the forest, the *sembal*, and the less massive and darker *pāpri*, all of which tower high above the ordinary trees.

To one traversing the forest its general aspect varies but little in different parts except that towards the hills it is for the most part manifestly thicker and more bosky than near the open plains. This results from two causes; 1st, many plants, such as the bamboo and various climbers, grow luxuriantly inside which are rare or absent in the outer forest; and 2nd, the additional difficulty of carriage tends to limit wood-cutting and thinning in the former (excepting as regards bamboo.) In the eastern or Kehar portion also where the ground is lower the forest is thicker and more verdant than in the

west towards Chāndi where it is high, dry, and as a rule much more open, as well as probably more cut seeing that carriage is easier from that end. But these variations are not very obtrusive, and in many places one may wander for miles without seeing a human being, a habitation, or a drop of water, or discovering much change in the appearance of things around him.

When the vegetation is at its richest, *viz* : during the rainy season, it is not safe to linger in this tract, and even so late as November, a visit to the depths of the forest is not particularly alluring, for not to mention the risk of fever which still lurks in its secluded corners, the appalling luxuriance of the as yet unburnt tall, harsh grasses, and half shrubby annuals is such that one feels stifled and anxious to get out of these almost pathless wilds to some place where the air of heaven can reach one more freely. Soon however come from the plains troops of woodcutters, and from the hills hundreds of herdsmen, and the axe of the one with the fires and cattle of the other speedily clear away the tangled mass of shrubs and tall herbage under which for months has been seething the deadly fever-poison.

When these clearances have been effected, in January, from up to the early part of the hot weather, the change is exceedingly pleasant from the glaring treeless plains, to the shady forest with its green glades affording picturesque glimpses of the Siwāliks and the giant Himalaya beyond, its fine trees its verdant creepers and the many flowering herbs of spring.

I now come to a subject which from its very materially affecting the past, present and future condition of much of the forest belt deserves special notice,—I mean malaria. Of the nature and causes of the influence we call by this name we know so little that the most extraordinary origins have been assigned to it, from that of the native who asserts the “*ayul*” to be produced by the breath of enormous serpents

which dwell in the recesses of the hills, to the scarcely less incredible theory of a scientific European traveller (Hoffmeister) who gravely suggests that the rapid evaporation from chalybeate springs may have to do with it.

This is not the place to discuss the various reasons assigned for the existence of miasmata in certain localities and their absence in others; but we know quite enough of its effects to say that in no hot country is it ever missing when we have, as in the forest belt at certain seasons, abundance of moisture in the earth and in the atmosphere,—a luxuriant vegetation when alive obstructing the circulation of the air, and when dead poisoning it by the reeking products of its decomposition,—and an almost total stagnation of aerial currents, owing as well to the shelter of the hills behind as to the existence of the forest itself. In the Sub-Siwalik forest we find all these in their fullest development and accordingly we also find that for a certain period of each year, good Bishop Heber's epithet of the "belt of death" applies with as much truth to it, as it might to the pestilential strip of the Mexican *tierraculiente*, whose deleterious effects have decimated every invading force, from the time of the early successors of Cortes, to the late French Expedition.

So serious and well known are the effects of the miasmatic poison in this belt, that from Gwálpára to the Ganges, the tribes who reside in it permanently are looked on with wonder by their neighbours on either side. In Bijnour, the Mechis who inhabit the Sikkim Taráí, and the Thárús who extend from the Gunduck to the Rámunga, are entirely replaced by the Boksas, who are also found in some numbers to the east of the latter river. From June to October it is said that it would be almost certain death for any but a member of an acclimatized tribe to spend a night in many parts of this tract, and so strong a belief exists of the increased power of the malaria by night that Captain Jones and Major Madden tell us of Kumaonees who in the unhealthy season regularly come

down in the morning to cultivate their fields below for the Kharif crops, to return in the evening to their hill villages.

Jones, who treats this subject with equal intelligence and good judgement, also gives some statistics derived from careful registration, showing that the evil effects of the malaria even in half cleared and cultivated spots have not been exaggerated. Perhaps the most striking of these is the fact that in 1844-5, the number of births to deaths in a certain section of the Kumaon Tarāi was 1,034 to 1,820, and again in another year 1196 to 1671, which he naively remarks "can hardly be considered a normal state of matters." The inhabitants themselves say of unhealthy places that "the women do not bear children there", and Jones describes with some feeling the gratitude of the people who brought up to him children that had been born and were thriving owing to his drainage operations having improved the salubrity of certain villages.

Nor is it only infant life which suffers. Instances are on record of large bodies of native troops actually rotting away in Tarāi forts or entrenchments to which they had been driven from the *des* by their enemies; and in 1772 a British force was decimated in the Tarāi.

The "jungle fever" which proves so fatal, appears to be an intensely active form of bilious remittent, approaching in character to yellow fever, and is invariably most fatal to those who have not been seasoned to the pestilential air of this region. Not that one need believe in the theory of acclimatization as popularly received, but there is no doubt that the poorly fed Mechis and Boksas live on in fair health for years in circumstances which would probably in a few hours kill a large percentage of an equal number of *ghi-fed* Brahmins, or flesh-eating Mussalmáns or Europeans.

Unfortunately the season at which the effects of the malaria are greatest nearly coincides with that when then their ulterior consequences are most felt, as about October occurs the chief necessity for properly ploughing for the cold weather

crop (*rabi*) so that the ground is thus apt to be very inefficiently prepared to the deterioration of the crop and ultimately of the soil.

All parts of the Rohilkhund forest belt are not alike unhealthy however, apart altogether from the fact that its western half when favouring circumstances are not so fully developed appears to be less insalubrious than the eastern. From the data given by various writers—in particular Captain Jones,—it is clear that the focus of the most active malaria is within a short distance of the wettest part of the Tarāi proper, when, in the rainy season, the whole ground is a sheet of morass. Nor is it less clear that drainage of some of the most unhealthy parts of the Tarāi has rendered them healthy, and wide clearings of various forest tracts in the Dehra Doon, as in these forests, have lessened their insalubrity very materially,—removing almost entirely the risk of “jungle fever” and leaving only the ordinary intermittent, to which the residents of very many places in India are more or less subject at a certain season of the year.

A question regarding the forest belt, which is not only interesting in itself but deserves some attention as bearing on future probabilities of its being cleared and cultivated, relates to the extent to which it may have been inhabited and tilled in former times; and it is the more necessary to examine this point as it is held by the natives and has been argued by various writers that at some former period the forest and Tarāi were very much more thickly inhabited and extensively cultivated than they now are. As there is an almost total blank in the history of this part of India at least for many centuries in the Mussulmán conquest, this question may best be considered under two heads, the one relating to the period before the hiatus, and the other to the time during which Mussulmán supremacy lasted.

It is almost unnecessary to say that the mere absence of material evidences of the tract having been thickly inhabited

at a period nearly as distant as our Era is not of much moment; and Sir H. Elliott (Supplement to Glossary Art "*des*") assigns only two reasons for his belief that at a very early date there was probably no Taráí but what was marked by rich cultivation and the populous abodes of men. Of these, that which depends upon an analogy with the then inhabited state of the Goruckpore jungles, as indicated in the itineraries of two Chinese travellers in the 4th and 7th centuries, would seem to apply with almost equal force to many parts of the tract, as to that in Rohilkhünd; and is hardly sufficient to make us credit that any people without strong pressure from some cause or other would forsake the fertile plains outside to cultivate what must have been a tract labouring under immense disadvantages ever since the geological changes which gave it its present formation.

The other reason given by Elliott, viz: that the allusions to scenery and vegetation in the Sakuntalá, indicate a very different state of matters on the banks of the Malin then to what exists now, has led me to go carefully over all the notes to a late edition of the drama, and to have various passages translated by a friend learned in Sanscrit. But amid the numerous and graceful allusions to vegetable life that are scattered through the Sakuntala, I can find very little which might not apply to the neighbourhood of that stream in the present day. Besides we may presume that the poetic license was at least as powerful in Kálidása's day as now, and as he was a resident of a distant part of India, and we have, I believe, no knowledge that he ever visited the scene of his drama, his poem with its possible embellishments could hardly be accepted as evidence on obscure and doubtful points. For instance, are we to receive his frequent allusions to the Mimusops Elengi (*Kesara*) as a proof that in his day that tree grew freely in what is now the Bijnour forest?

On the east of the Ganges, I know of no discoveries of ancient buried cities like that at Behut, formerly alluded to

(at page. 271) the early date of which was approximately settled by the coins found in it.

The evidence, traditional, written and material, respecting the degree of populousness of the northern part of Rohilkhund in the days of Mussalmán rule in India, is fuller, though perhaps not much more explicit and satisfactory than that which bears on the earlier period. The clearest of the statements on this point in native histories is that the Chourassie mull (so called from its length 84 coss ?) which comprized a strip of Rohilkhund from the Sardah to the Phika naddi, derived its second name of Noulukhia from yielding 9 lakhs of revenue, but this is considered a manifest exaggeration by the best authorities. And although it is on all hands acknowledge that during the palmy days of Mussalmán supremacy much of this part of Rohilkhund was, under the Chand dynasty of Kumaon, well populated and prosperous, yet Elliott's argument from historical facts that on the whole it was less thickly peopled then than now, appears to be conclusive. Thus, almost every allusion in Mussalmán histories to the country north of a line which runs far to the Southward of the Tarái, shews that, making large allowance for exaggeration, the extent of jungle in these parts was then such as we now can have no adequate conception of: and the country adjoining the Tarái was then so inhospitable and insalubrious that although in one reign (Akbar's) the Royal troops invaded it twice, they made but a short stay. In point of fact a wide tract from the foot of the hills southward was never permanently annexed by Delhi which it would unquestionably have been at whatever risk, had the name Naulukhia been aught but an Orientalism.

The argument of Captain Jones from material evidence seems to me equally conclusive. He points out that although we find many traces of disused canals and orchards &c. in parts of the Kumaon Tarái, originating as he conceives during Pathán rule, and the same is though to a less extent true

with regard to that of Gurhwal, yet there are almost no proof of continuous populousness and prosperity, such as temples and mosques, which must have existed had the state of things been as represented under either Hindoo or Mussalmán rule. Further, had the amount of irrigation in and near the Tarái been at any former period anything at all approaching to what it came to be under Jones' fostering hand, the country must have been impassable for want of bridges. No trace of these exists, whereas he mentions a particular part near Kooderpoor, where in a space of 24 miles he had to build no fewer than 70 canal bridges.

Although the above reasons, as I conceive, indicate pretty clearly what was the state of part of Rohilkhund east of the Ramgunga during the Mussalmán sovereignty, yet the details given in the Ayeen Akbery show that at the close of the 16th century the plain country now included in the Bijnour district was more or less populated up to nearly its present line. But that it was not cleared and cultivated further up than this during the existence of Rohilla rule in these parts is shown by the fortified places, whose age is indicated by tradition as well as by the trees growing on them, that are found here and there in the Bijnour district at the junction of the Tarái and forest proper, which would naturally be the locality chosen for a last retreat by the Rohillas when pressed by their enemies from without.

With regard to the forest proper inside the Tarái but little argument is required to determine that it never has been, and with its present physical structure it is not at all likely to be thickly peopled and extensively cultivated. For even were the jungle cleared, without water almost nothing, and in many places even with water nothing can be done; and no amount of care or engineering could carry the available water very much further on in Bijnour forest than is done at present.

Still it is more than probable that at various periods antecedent to our rule, many fugitives were driven by the intes-

tine troubles prevailing in the plains outside and the hills above, to seek refuge in the Rohilkhund forest belt. In its depths if they were annoyed by drought, harassed by wild animals, and decimated by disease, they might at least be far from a greater evil than any of these, the enmity of their fellow-men. Not only tradition but clearings and the remains of orchards in various parts of the forest attest that this was the case; though, that this tract was not reckoned a very enviable place of abode even when war and rapine held sway on either side of it, is evidenced by the circumstance that under the Goorkha rule of Kumaon, a free pardon for any crime was offered to malefactors who would consent to settle in a royal village in the forest.

It appears then that so far as attainable proof goes the "golden age" of this region to which native tradition points, is as mythical as many others of its wonders. As an illustration of the extravagance of some of these I may mention that a native gentleman informed me that the country people believe the fort of Patthargarh at Nujeebabad which is less than 100 years old, and which consists of a high and massive embattled wall with bastions, gateways &c., enclosing a space of 35 to 40 acres, to have been erected with materials taken from a single *burj* of an old fort in the forest a few miles to the north. The latter must have been a tolerably extensive structure.

But little need be said of the nature of the soil of the Bij-nour forest for although a multitude of names are in use by the natives to designate the varieties of soil, in various parts of it, yet what has been already said (page 272) sufficiently indicates its general character, and but little remains to be added. Practically it may be divided into 3 sorts. First, that of those parts when the shingle has little or no covering of vegetable or other soil. These are not of great extent, and even were water available for irrigation, would still be almost totally unproductive. Second, the sandy tracts, which are also of limited extent, and generally situated in the neighbor-

hood of the numerous broad stream-beds. Third, those parts where there is a considerable amount of fertile soil constitute the larger portion of the forest ; and the soil is both rich and deep along the inner edge under the hills, as well as near the canals, and in the marshy places which occur here and there throughout the outer part of the belt ; in all of which situations much of the land has been cultivated, irrigated and manured more or less continuously for many generations. Outside the forest proper also, in the Tarái, there is abundance of rich vegetable soil which only wants drainage.

But in many of the clearings at either edge of the forest, as well as in those of the Boksas within its bounds, certain crops cannot be profitably grown, in especial the pulses most kinds of which are very apt to be destroyed by insects, a plague which the peasants say is far worse during the prevalence of the east wind (*Purwa*) than at other times. Nor is this the only danger to the crops, for unless close watch is kept, elephants, pigs, and other wild animals commit great ravages.

The chief autumn crops (*kharif*) cultivated in this tract are rice and Arum (*gevínyá*) with some maize, and *mandua* (Eleusine). The principal winter crop (*rabi*) is wheat, with some barley, and the mustards* (*lahí* and *sarson*) for oil. During the cold weather also an immense quantity of tobacco is cultivated in all the clearings, for, although the leaf produced is not reckoned so delicate in flavour as that of the plains, yet the enormous amount of manure produced by the hill-men's herds and accumulating about their *gotes* causes its yield to be very large. Its cultivation in the Boksa clearings appears invariably to be conducted by gardeners (*santí*) from the plains, who reside in the forest in the cold weather expressly for that purpose, in almost every case returning to their homes outside after the crop is gathered. The Boksas allege that they themselves are prevented by a caste-restriction, from engaging in this very profitable cultivation.

Although as we shall by and bye see, the cultivated land is gradually encroaching from outside on the forest, yet after visiting very many of the clearings inside it, it seems to me certain that these have of late years decreased very considerably both as to number and extent, and the cause of these two apparently contradictory circumstances is not very difficult to find. Increase of cultivation, and regulation of the water-courses in the Taráí proper, lessens and in time may almost annihilate the malaria which is the great obstacle to its becoming fully reclaimed and populated: whereas the more attention that is paid to cultivating the strip just under the hills, the less water for irrigation will reach the clearings below in the forest, where a deficiency of water is *the* obstacle to much increase of cultivation.

The levels appear to render it impossible to utilize for irrigation-supply to any great extent, the first part of the extra mountain course of the Ramganga, and the other 6 or 8 smaller streams which perennially have water beyond their debouchement from the Siwaliks, already are largely applied to irrigation as near that point as possible, round which on even the smallest there is always a cluster of fields. Near these points also are generally the places pitched on for the cattle *gotes* of the *paháris*, as here and there only for miles can be obtained water for drinking and cooking and for the herds. No doubt in some cases greater economy might perhaps be exercised in regard to the small canals carried off from these streams, but in almost no case, I should think, enough to double the present amount of cultivation. From the largest of them, the Khop, is fed the Nugeenah canal, which however is applied to irrigation outside the forest tract. The Malin and Kiwásan are the next in size, and from either side of each near the Siwaliks small canals convey the water to the lands below; in one case, that of the canal from the east bank of the Malin, serving to irrigate the fields near Jafirabad, 7 or 8 miles distant from its source. The irrigation effected from

the rest of the streamlets is confined to small patches of clearing in the immediate neighbourhood of their point of issue from the hills, the quantity of water they yield being too small to be carried to any great distance.

But it is high time to turn to the special vegetation of the forest. Although it has been the habit of some writers to describe the climate of the whole of the Sub-Siwálik belt as tropical yet, of the elements which may be considered to constitute a tropical climate viz. heat, uniformity of temperature, and great moisture, we have seen that only the last is very marked here, and that not at all seasons of the year. The comparative stagnation of the air from the nearness of the hills and the abundance of trees, doubtless (though I can give no figures on this head) causes the heat in the hot and rainy season to be greater in the forest than in the open plain, but this is perhaps more than counterbalanced by the increased annual range from the greater cold of winter.

Still, so great is the effect of shelter, summer heat and moisture, that the flora has some peculiarities, and includes a large proportion of arboreous forms which is one characteristic of tropical vegetation. And although to the west of the Sardah we find none or only single species of the Dilleniaceæ, Anonaceæ, Dipterocarpaceæ, Guttiferæ and Piperaceæ, which abound in the extreme south east of the tract, yet even as far as and beyond the Jumna creep many plants common to Lower India, Sylhet or the Peninsula, which are no where found out in the open plain parallel to this. The most marked of these which are found in the Bijour forest are the following trees; *Bignonia* (*stereospermum*) *enamolens*, *Conocarpus latifolia*, *Garuga pinnata*, *Gurteria velutina*, *Hymenodictyon excelsum*, *Lagerströmia parviflora*, *Phoenix acaulis*, *Salix tetrasperma*, *Schleichera trijuga*, *Spina Wightii* and *Ulmus integrifolia*.

Nor are the Fernæ entirely unaffected by the causes which influence the extension so far north-west of these members of

the Flora, for in these forests from Upper Assam to the Ganges, from on into the Doáb are found,—to name no animals of lesser note and none which are doubtful—the Elephant and Python, tropical animals whose range is nearly as liable to be affected by climatic changes as is that of tropical plants. (I believe some instances are given of even the Rhinoceros having been found to the west of the Sardah.)

Some of the causes which tend to bring the above and such like plants so far to the north-west as this, and which would have a much greater effect were they not to some extent counteracted by the great depression of temperature in the cold season, and the meagre depth of soil over an inhospitable sub-soil, are in still greater force in the sheltered Doons and other valleys and recesses of the outer Himalaya. Then, not only is the luxuriance of the vegetation still greater than in the forest outside the Siwaliks, but some tropical cultivated plants (as the Jack, *Artocarpus integrifolia*; white guava, *Psidium pyrifera*, and various kinds of lime and plantains mentioned by Royle) thrive better than in places in the plains abreast of this. Besides this, several trees and other plants requiring a high temperature and much moisture are indigenous in the Pátlí Kolpeí and Dehra Doons, which do not grow or are exceedingly rare in the Rohilkhund forests. As examples of trees coming under this category may be mentioned *Acacia elata*, *Sapindus*, *Pentaptera Arjuna*, *Elaeodendron dichotomum*, *Diospyros embryopteris*, *Calamus Roylei* and *Harina oblongifolia*.

As a pendant to these are to be noted some plants, as *Trewia nudiflora*, *Pongamia glabra*, *Cotonea Bengalensis*, *Alstonia scholaris*, *Artocarpus Lakoocha*, and wild Plantain (*Musa*) which extend from the westward up to the eastern part of the Rohilkhund forest, but do not seem to cross the Ramgunga into Bijour. (Curiously enough however, one of these, the *Pongamia*, again appears sparingly far to the west of this beyond the Sutej.)

There are still other classes of plants which appear to find their limit here, *e. g.* those which come from the north-west, such as *Nerium odorum* which is found in abundance near the mouth of the Kothrí Doon at the boundary between Gurhwál and Bijnour, and Europæo-Himalayan plants such as *Taraxacum officinale*, the common Dandelion, which I observed growing profusely at one place in the Bijnour forest.

I am aware of no foreign plant which has become naturalized here, except (the now universal *Argemone Mexicana* and) *Martynia diandra*, *bíchr*, which grows spontaneously in several parts of the forest, and which is mentioned by Mad-den as occurring in some places to the eastward. This, a South American plant, has been noted as growing and spreading freely in other parts of India, as at Bombay.

There is nothing peculiar in regard to the only 3 Ferns which are found in the forest clear of the Siwálik skirts, as one of them, *Adiantum capillus Veneris*, (Maiden hair Fern) is common in wells in the plains of the N. W. Provinces, and the other two, *Polypodium proliferum*, and *Pteris longifolia* are occasionally found in damp shady places a good many miles outside the forest belt.

From the peculiarities here indicated, and the fact that a very large proportion of the commonest trees of most parts of the forest, are found neither in the hills nor in the plains abreast of their place of growth in this tract, the vegetation of the latter may well be termed *sui generis*; so much so as to occasion Dr Hooker's remark that from the outer border of the Taráí to the limits of perpetual snow, there is no botanical region more clearly marked than that of the forest belt.

The writer just quoted calls this tract specially the "region of forest trees" and one of its most striking characteristics, particularly noticeable in places where the wood-cutter does not find it pay to ply his trade, is as I have before hinted, the predominance of arboreous forms. And this peculiarity

is the more marked that the frequent fires lighted for the purpose of keeping down the long grass, tend also very much to check the growth of shrubs and all but the strongest woody climbers. These last are nowhere to be seen in great abundance except towards the inner edge of the belt, where the thickness of the forest and the excessive moisture encourage their growth and preserve them;—and at no place which I have visited is the luxuriance of growth such as to justify the remark of one observer in speaking of the rich vegetation of a place in the Kumaon Bhabur “no American forest North or South can possibly exceed it,” still less justify the term “impenetrability” frequently applied to its denseness if we use that word strictly as Humboldt suggested.

In proceeding to consider the individual trees and other plants yielding timber and minor products in the Bijnour forest, the preferable arrangement of them has been a subject of some perplexity. A botanical arrangement would be too technical and presents no compensating advantages, while on the other hand an alphabetical catalogue of the native names though seemingly simple, has great inconveniences, chiefly owing to the varying methods of spelling native words, and the fact that in some cases, several native names are given to the same tree within a few miles. I know of no circumstance against which, as throwing difficulties in the way of our identifying the products of Indian plants and systematizing our knowledge of their properties, botanical writers, from Buchanan Hamilton to Hooker, have inveighed so strongly as the tendency of many people to hold fast and swear by native nomenclature with its variations and uncertainties.

Any arrangement founded on the nature and uses of the various products seems beset with difficulties and inconveniences, and although I can hardly flatter myself that I have hit the juste milieu by arranging the botanical names in an alphabetical catalogue, followed by the respective native names, yet

this method appears to me to labour under fewer disadvantages than any of the others.

I have included in the following list every plant large and small, known to me in this forest, as yielding timber or any other useful product whether for home consumption or export, as well as one or two useful trees &c. which are doubtfully indigenous in it, and a very few plants which from their striking appearance or connection with others which are useful seem to deserve a place here.

The native names are spelt from pronunciation, as nearly as may be according to the system used by Shakspeare, so as to ensure some degree of uniformity, the ordinary way of spelling being added in cases when that differs much from the former. Native names derived from sources other than personal investigation, and in one or two cases native names in common use in neighbouring districts, are given in brackets. To prevent possible confusion the botanical name which has been commonly used for particular trees is always given, the more correct name where it has on authority been recently altered being inserted in parenthesis.

I have taken considerable pains to attain correctness in regard to the rates of price, and the first column contains that usually charged on the article, ere removal from the forest, while the second gives the ordinary price at Nujeeabad, the nearest mart.

List of Timber trees and useful Plants of the Bijnour Forest.

Name with forest rate and price at Nujeeabad.

1. *Acacia Arabica*, Willd : *babúl*, *kikkar*. This well-known and useful tree is common, planted in the open plain, but I am very doubtful if it grows any where in these forests truly wild. The timber is never of a large size in these Provinces, but being fine grained and tough, it is in most parts of India much used for building, axles and wheels, and for making charcoal. At Bombay, kneed timbers for ship-building are

made from it. A gum (*babál ka gond*) identical with Gum Arabic, issues from its trunk, and its bark is used in tanning and medicine.

2. A. Catechu, Willd : *Khair*. This tree is or has been abundant along all the minor portion of the forest-belt. It yields a hard, close-grained, heavy wood, which is *very* durable and is said to turn well. It is valued for plough-shares, axles, pestles, pins &c, but its special use is for making the crusher (*chúran*) of sugar and oil-mills, for which purpose it is said

3 yds × $\frac{1}{2}$ yd. 1/ to 3 rupees. to yield to tamarind only.

The fact of all the larger trees having been used up here, is assigned as the reason why little or no manufacture of catechu (*kathá*) from its wood, is carried on, though a great deal, for

$1\frac{1}{2}$ seer 1/. use in dyeing and medicine is made, east of the Rámunga.

3. *Acacia elata*, Wall : *kareo*, *baron*. I doubt if this tree, the timber of which is like that of the *seris* (No 5) and is used for wheels, furniture &c, comes outside the Siwálíks. It is common in the Doons, and is a tall, very handsome tree, with smooth, light coloured, greenish grey bark.

4. A. — ? *siron*. This tree I only found on the skirts of the outer hills, though it is common in the Doons. It has a lightish grey bark, curiously wrinkled, and its timber is hard, light and strong and much valued in some parts of India.

5. A. species : *siris*. Although this tree grows well when planted in the plains, it does not seem to be truly wild any where in the forest. It is rapid grown, dark-barked, smooth-trunked, and wide-spreading, and its heart wood yields a dark-coloured, hard, and very heavy timber, which is used for building &c., and being durable and not liable to be attacked by insects it has been recommended for railway sleepers. In this district

$4\frac{1}{2}$ yds. + $\frac{1}{2}$ yd. 3/.

it is frequently used for oil-mills (*kolhú*) and the oil is supposed by entering its pores to make it stronger. It is less lasting than *siseri* (No 47) and in Baker's experiments. a bar 6 feet long, and 2 inches square broke with 709 lbs.

The bark is said to be used for application to hurts of the eyes, and a gum oozes from its trunk, but I am not aware of its being any where collected in quantity.

6. *Ægle Marmelos*, Corr : *bel*. Has been very abundant all over these forests, but recently much of it has been cut down for charcoal, for which it is well adapted. It grows to 20-30 feet and is a handsome though small tree, with a light-grey smooth bark, and when old a columnar (fluted) trunk. Its flowers have a delicious honey smell. The timber is light 3½ yds. x ¾ yd. — /12. coloured, hard, and strong, and is sometimes used for crushers (*chúran*) but is said to last only one year.

The fresh fruit is used for sherbets, and its dried pulp 1 Maund 2¼ lb. — /1. (*bel-gíri*) is much valued and of considerable efficacy in some forms of bowel-complaint.

The rind is used in dyeing yellow, and the Dutch in Ceylon are said to have manufactured a perfume from it.

7. *Andrachne trifoliata*, Rox : ?. An exceedingly rare tree in the inner part of the forest (and occasional in the Doons.)

8. *Andropogon involutus*. Stend : *bhábar*. This grass, which is abundant in this part of the Himalaya and occasional on the skirts of the Siwaliks, appears to furnish almost all the material called *bhábar* so largely used for string in these parts. Botanists, from Wallich and Royle downwards have stated this to be the produce of *Eriophorum comosum* (No 54), of which however, apparently only a very small proportion of that brought to the plains consists. Dr. Brandis first drew

1. Maund — /8. my attention to the probability of the ordinary belief being erroneous, and subsequent enquiry has shown that the case is as above stated.

The string is very coarse, but strong, and although there 1. Maund 2/— is great waste in the manufacture, exceedingly cheap. It is well adapted for boat-ropes, the rope work of bedsteads and other ordinary purposes. Possibly the *bhábar* may come into play as a paper-material, at least it is

worth the trial, and probably larger quantities of the raw article could be got than of any other fibre that I know of in this part of the Himalaya.

9. *Antidesma paniculatum*, Willd: *amlī*, *mendla* (surshoree). Rare outside the hills, timber small and worthless. Its acid (" *khatta mithā*") fruit is eaten, and also applied, as a discutient to boils by natives.

10. *Bambusa stricta*, Rox: *bāns*. All the Bamboo of this forest and the neighbouring Doons probably belongs to this species. It forms one of the most valuable products of the forest, and will be alluded to more fully hereafter.

The cut bamboos are divided into the following kinds, beginning with the least valuable, in regard to paying the forest rates, and for sale.

2000 240 1. *Chanējū*, long and thin; for roofs (*chhap-*
4/8 - 1/- *par.*)

2. *Lāthī*. *lāthīchūr*, thicker, shorter, solid, for walking sticks and clubs.

3. *Bālū*, similar but much thicker, for sides of bedsteads &c.

4. *Kanerwā*, between the two last in thickness, but hollow; for *chhappar*.

5. *Sarūicha*, much thicker, short, hollow; for *chhappar*.

6. *Dashatta*, similar, but much longer.

40 7. *Bhengi*, thickest of all, and less hollow; for tent
1/- and doolie poles &c.

In the cavities of the joints of various species of bamboo, as is well-known, the curious form of silex called tabasheer (1 Seer (*banslochan*) is found. It is used in medicine by 4/ to 6/- natives, but appears, from its price, to be rarely formed or collected here.

I may mention that the flowering of this species can be by no means uncommon, as, each of the three years that I have botanized in or near the Siwāliks I have found a large percentage of the plants in flower.

11. *Bassia latifolia*, Rox: *mahwā*, *mowā*. This tree, if indi-

genous at all, is so exceedingly rare on the skirts of the Siwāliks, as to be economically valueless.

12. *Batis spinosa*, Rox : *mandā*. A small tree occurring in some places near the outside of the forest, but, so far as I am aware, no part of it is applied to any special use.

13. *Bauhinia parviflora*, Vahl. &c.

14. *B. purpurea*, L. *gúriál*, *kachnár*. Both of these small trees are common along the innermost fourth of the forest,

12 *Maunds* 1/10.— and their wood is used for domestic purposes. The bark of the latter is said to be employed in tanning, but the buds (*kallí*) do not appear to be eaten here, as they are in the plains.

15. *B. racemosa*, Vahl. *málú*, *máljan*. This enormous climber is common only along the inner edge of the forest, close to the hills; within the latter it is abundant, and here, as in other parts of India, from its bark is extracted by beating and steeping, a strong fibre from which ropes are made. The seeds (*toúli*) are eaten by natives, and said to taste like cashew-nuts.

16. *Berchemia laxa*, Royle? *dakki*, *kajei*. A small tree, occasional all over, of no special use.

17. *Bergera Koenigii*, L. *gaudela gúndí*. A shrub, common along the outer and inner edges of the forest. Its aromatic leaves appear to be less frequently used for flavouring curries in this part of India than in the Peninsula.

18. *Bignonia Indica*, L. (*Calosanthos*, Blume) *úlú*, *fareda* (*pharkath*). A small tree occasional all over, wood soft spongy and useless.

In the plains the paper-like wings and the seeds are applied to abscesses.

19. *B. suaveolens*, Rox : (*Stereospermum*, D.C.) *padál*. A tall tree with a smoothish grey bark, becoming dark, and flaking off irregularly. Common throughout, and furnishes

Cart load —/6 a useful second rate timber, for planks, small
4½+1½ yds 1/3. beams &c.

Its seeds (*gúthk*) are by the natives applied behind the ears in certain eye-diseases, in domestic medicine.

20. *Bombax heptaphyllum*, Cav: *semal*, *sembul*. This tree whose enormous buttressed trunk, and in spring its showy red flowers render it a striking object, is or has been common all over the Forest.

Its timber is soft, coarse-grained and not durable, and is $5 \times 1\frac{1}{4}$ yds. $1\frac{1}{2}$. mostly used for boxes, planks, hollowed out tubs &c. *Nimchaks* for wells are also made of it, and from its lightness it is employed for hollowed out canoes, which are in use on the Sardah and Ganges. It is useful also for floating timber rafts and on the Bombay coast for making fishing-floats.

Its flower-buds (*simlantá*) are cooked with salt and pepper and eaten by natives; and an astringent gum (*mochras*) which 1 Maund, 1 Maund, exudes from the bark is collected and —/4. 3/— exported being given in medicine for diarrhæa &c.

21 *Bradleia* sp: ? *daraula*, *geya*. A small tree occasional in various parts of the forest; of no special use.

22. *Buchanania latifolia*, Rox: *kath-bhilāwa*, (*mūriā*, *piyāl*.) A small tree with a thick, very dark bark, tessellated by furrows into small quadrangular pieces, common only along the innermost edge of this forest, but abundant in the outer Siwāliks. Its wood is soft and worthless.

The large leaves are used as dishes by the natives. The bark is in some parts of India used in tanning; and the oily kernel of the fruit, appears here as elsewhere to be eaten like almonds in confectionery. In the Peninsula, a bland oil is occasionally extracted from the kernel.

23. *Butea frondosa*, Rox: *dhāk*, *dhakkā*. Inside the forest this gets to be quite a large tree which it almost never is outside in the plains, but it does not extend to the innermost part of the belt. Except as fuel, and as supplying a light 12 Maunds 1/— charcoal fit for gunpowder, its wood is

worthless here, and it appears to be used for building &c. in those parts of India only where decent timber is very scarce.

Dhák Ke-gond is very similar to gum kino and is used as
 1 Maund —/4 : an astringent in medicine and in dyeing
 11 Seers 1/— : blue. I cannot find that its extraction is
 in this forest carried on largely, but the tell tale incisions on
 the trees in many parts, shew that it cannot be long since it
 was so.

The flowers (*kisú tisú*) are exported towards Central India to be used (with lime) as a red dye,—in the *hote* powder,—and as an external application in medicine.

In some parts of India a large amount of strong rope is manufactured from the fibre of the root-bark, which is here also occasionally employed for this purpose.

24. *B. parviflora*, Rox: *mendhārā* (*maulā*). An immense climber, growing only in the innermost part of the belt. In Southern India, its gum is used medicinally.

25. *Cæsalpinia sepiaria*, Rox: *aglan*, *rárt*. A large thorny climber with showy yellow flowers which occurs in the innermost part of the belt. I am not aware that it furnishes any useful product. It is called the “Mysore thorn” having been much used by Hyder Ali for the boundary-hedges of his strong-holds.

26. *Callicarpa incana*, Rox: (*duya*). A large shrub, common in various parts of the forest and so far as I know, useless.

27. *Cannabis sativa*, L. *bhāng*. A common weed in all the forest clearings, but appears to be nowhere cultivated, nor is rope made or *charras* collected from it. Its tops however are frequently dried for home-use, as *bhāng*, but this is not nearly so much esteemed as that from the hills, which alone is said to be bought and sold under the Government license.

28. *Careya arborea*, Rox: *kumbh*. This tree is not found external to the skirts of the Siwāliks and its wood is here
 12 Maunds 1/. reckoned almost worthless except for fuel,

as its price indicates, but it is stated to be pretty durable if kept dry (a Bombay authority however says "it resists water well") and being mahogany-coloured and well veined is employed at Monghyr for making ornamental boxes and in the Peninsula for regimental drums.

In some parts of India, a strong, coarse cordage is made

2. Yds. 3 pie. from its bark, which here and elsewhere is used for gun-match, (*torá*).

29. *Carissa diffusa*, Rox: *Karounda*. A shrub common in many parts, but not in the thickest of the forest. Its fruit is never aught but small, stony and sour.

30. *Casearia tomentosa*, Rox: *chila* (*cheela*). A small tree whose wood appears to be very little used except as fuel; abundant all over the forest.

Its fruit is put into streams and ponds to kill fish, which are said not to be rendered unwholesome by being thus poisoned.

31. *C. Hamiltonii*, Wall? *náro*. A shrub rarely found in the innermost part of the belt.

32. *Cassia fistula*, L. *amaltás*, *kitwáli*, *simhára*. The "Indian laburnum," conspicuous for its smooth very light grey bark, and fine yellow flowers; is common all over the forest, especially towards its inner edge. Its timber is worthless, being very brittle, and particularly subject to the attacks of insects.

Its bark is used by dyers; and from the pulp of its fruit

4 Seers. 1/— (*talwáli*, *amaltás*) are prepared confection (*gulkand*) and pickle (*achar*); and it is also employed in medicine.

33. *Cedrela toona*, Rox: *tin toon*. But very few specimens of this tree, even of moderate size, are left in any part

Old wood 1 maund /4 of the forest. Its timber is light, fine-grained, mahogany-coloured, and when properly seasoned is well known as an excellent furniture wood; and on some of the Assam rivers, admirable boats are built from it. Its specific gravity is only 640, and a six feet bar two inches square, was found by Baker to support 800 lbs.

It is an interesting fact that in the small family to which this tree belongs, there are four others which yield valuable timber, and only one of them, Mahogany, (*Swietenia Mahogani*, L.) is extra-Indian. The others are satin-wood (*Chloroxylon Swietenia*, D.C.) *rohunna* (*Swietenia febrifuga*, Rox :) and Chittagong wood (*Chickrassia tabularis*, A. Juss :) all found in the Peninsula, the last also in Eastern India.

34. *Celastrus paniculata*, Willd : *málkagne*. This climber which occurs in the inner part of the belt, yields seeds from
 1 Maund /4 which is extracted an oil, used as a liniment
 13 Seers 1/ in rheumatism.

35. *Celtis Caucasica*, *kharak*. A tree with grey smoothish bark and curious circular wrinkles ; occasional all over the forest, yielding a soft white wood which is but little valued.

36. *Cissampelos Pareira*, L. *nirbasha*. An herbaceous climber, occasional in the forest (and abundant in the open plains) whose leaves are applied to abscesses.

37. *Citrus medica*, L. (?) *nímbú* (*bijoura*). The wild citron, occurs at one or two places in the forest. Its fruit is used for making pickle (*khatai*).

38. *Cochlospermum gossypium*, D.C. (*katera*, *gujra* ?). A small tree with dark grey bark grooved by broad furrows, and with a very large yellow flower which appears before the leaves. This does not extend further outward than the skirts of the Siwāliks.

I cannot find that the gum of this tree (*katira ka gond*) is
 5 Seers 1/— collected here, and what is sold in the bazars is said all to be brought from the East.

39. *Colebrookia oppositifolia*, Smith. *binda*, *bausá*. A shrub
 Wood, 12 maunds 1/- which is common in the inner part of the forest and occurs all over. Its charcoal is (or was) much used for gunpowder.

40. *Conocarpus latifolia*, Rox : *dháori*. (*báklí*). This tree bears a very strong resemblance in general appearance and leaf to *Lägerstömia parviflora* so that they are apt to be

confused, and in fact frequently are so. This is a handsome, tall tree, with smooth, light grey bark, and is common over all the inner $\frac{2}{3}$ of the belt. Here the timber is in no request and is only used for planks, bedsteads &c. but in Central India and the Peninsula generally it is much valued, its chocolate coloured heart-wood in particular being reckoned extremely durable, and in various places it is used for beams and rafters, cart-axles and naves. It is said to be considered by

Cart load	4+1½ yd.	natives superior to almost any timber
—/8	2/—	except teak for ship building.

The leaves are used by tanners, and from the bark exudes a gum which is collected here, as elsewhere in India. Here

1 Maund	10 Seers.	it (<i>dháorí ka gond</i>) is chiefly mixed with
—/3	1/—	and sold as the inferior sort of gum of

the Odina Wodier.

41. *Cordia incana*, Royle (*Gynaion vestilum*, D.C) *kúm* (*peen?*) This is no where within my knowledge, a common tree, but occurs occasionally throughout the inner part of the forest, as in the lower Himalaya. It never grows to be a large size, but its timber is hard and lasting, and is used for mill work, naves of wheels &c.

42. *C. latifolia*, Rox: *lisára, gája*. A well known, moderate sized tree having smoothish light grey bark with shallow spiral furrows, which is not uncommon (planted) in the plains, as well as throughout the forest.

Its timber is hard and heavy like that of the last, and is

3+1½ yd.	used for oil-mills, and for making the drag by
2/—	means of which the clods in fields are broken up.
5 Seers,	
1/—	Its fruit is used in medicine.

43. *Crætava* Roxburghii, Br: *barná*. A small tree common in the inner half of the belt, (and occasional, planted in the open plain). It yields no useful product here, so far as I know, although the root, juice, bark, leaves, and seeds of this or a closely allied species are all employed medicinally in the Peninsula.

44. *Cucumis pseudo colocynthis*, Royle. *bislúmba*. The fruit of this is collected largely in and near the forest, for use in medicine. It yields a purgation nearly equivalent to our *Colocynth*.

45. *Dalbergia lance*: L. *bíthúá (takólt)*. A fine handsome tree, with a smooth, ash-coloured bark, which flakes off, common in several parts of the forset. Its timber is here said to be almost worthless, but it is reckoned valuable for many purposes in various parts of the Peninsula, where its seeds, leaves &c. are used medicinally.

46. *D. Ougeinensis*, Rox. (*Ougeinia dalbergioidis*) *sándan*, *sánan*. This tree which is common in the outer hills, hardly extends beyond them except in a very stunted and scraggy form. Its timber is hard and strong, and very similar to that of its congener *sissú*, and is much valued for wheels, ploughs, furniture &c. In the Western Presidency a kind of Gum Kino is collected from it, but I cannot hear of any such product being known here.

47. *D. Sissoo*, Rox: *sissú*, *sissoo*, *shisham*. Young trees are abundant in the forest, on islands and the banks of streams only. Its well known and excellent timber is seldom long and straight, but is in great request for furniture, building, and gun-carriages, and on the coast for use in the dock-yards. It has a specific gravity of 724, and is very strong, a six feet bar, two inches square, having in Baker's experiments only broken with 1104 lbs. It is said to be obnoxious to the attacks of white ants.

48. *Dioscorea versicolor*, Wall: (*Helmia bulbifera*, Kunth) *gíthi*. This climber is of considerable interest, as its large tubers furnish the yam which supplies great part of the food of the Boksas when grain is scarce. The plant is common throughout the forest and its tubers which grow to several pounds' weight, are got at by digging from two to six feet.

To remove their original acridity, they are always steeped for a night in ashes and water ere being cooked.

As a curious instance of the power of vegetation, I may mention the following. A piece of a tuber about $\frac{1}{2}$ a pound in weight having been put aside among some specimens, soon after the rains commenced I found that it had shot out a young stem a foot long through the folds of the paper in which it was wrapped. It was then tied up in a woollen stocking, without a particle of soil, hung up in a verandah, and liberally watered. In six weeks, until it was unfortunately broken off, it sent out to a length of nearly 20 feet its climbing stem with abundance of leaves, but without manifesting any disposition to flower.

This species of yam (allied to the common cultivated *rátalú* of these parts, and to the West Indian yam) is found in many countries within and near the tropics, and it, as well as several of its wild congeners, is used as food in various other parts of India. Its roots were largely eaten by the multitudes of starving poor who were employed on the Mohna pass road in 1861.

49. *Diospyros* —, *tendú*, *abrus*. This tree, which grows to no great height, and has a dark-coloured bark cut into quadrangular tessellations by longitudinal furrows and shallower transverse cracks, is not now to be found in large quantity in any part of the forest, and towards the western end appears to be quite extinct.

The *Diospyri* furnish most of the Ebonies of commerce, some of which are in Europe largely used in cabinet work, but mainly only in veneering from their being liable to warp and crack. The heart wood of this species which is of a fine black colour and not liable to the attacks of insects supplies the local manufacture of ebony work-boxes &c. at Nugeena; of which the carving though rather plain, and perhaps somewhat unvaried is very neatly executed. Ere a tree is cut down an incision is made

1. Maund.	10 seers.	black colour and not liable to the attacks
—/8	1/—	of insects supplies the local manufac-

into it, to find out if there be much *mal* or heart wood as the outer wood is entirely useless, and this practice, though necessary, doubtless injures many trees.

The fruit which is globular and about the size of a pigeon's egg, has a sweetish, astringent, and not unpleasant taste, and is eaten by the natives.

50. *D. Montana*, Rox: (*urdinia*?) This small tree which is still more rare than the last, does not appear to afford any ebony, nor does it at all resemble the former in appearance, but it is not unlike the *Diospyros* (*D. Lotus*?) which produces the *amlak* fruit of Afghanistan.

51. *Ehretia aspera*, Rox: *chamror kodah*. A tree with whitish, very smooth bark not uncommon throughout the forest. It grows to no great size nor is its timber much valued.

Cart load	10 maunds.
/6	1/—

Goats are fond of its leaves and the herds-men (*goriyas*) chew its bark with catechu as a cheap substitute for the regular *pán*.

I have included under this name more than one of the species of Royle and others, which, as existing here and to the North-west, seem to me, after collecting them in many places hundreds of miles apart, to be only variations of one species.

52. *E. serrata* Rox: *panden*, *pūná*. Uncommon outside the hills but occasionally planted at villages, I presume on account of its fine honey-scented flowers.

Its wood is not valued here but in some parts of the Peninsula is found to be tough, light, easily worked and durable, and is much used for sword-belts and gun-stocks.

53. *Embllica officinalis*, Gaert: *aorilá*, *amla*. A well-known small but handsome tree with very smooth ash-coloured bark, common, planted at villages &c. in the plains, and found all over the forest. Its hard, strong, straight grained wood is valued for gun-stocks &c. and is said to be particularly durable under water.

$4\frac{1}{2} \times 1\frac{1}{2}$ yds.
1/2.

The leaves, bark &c., are used medicinally in various parts of India, but the fruit is universally the chief product. It is not edible as plucked, being intensely sour (whence the native name) but is collected all over India for dietetic and medicinal purposes. It is made into pickle (*áchár*) and the soft part dried (*ddl-áonlá*) is eaten as a relish. In medicine it is esteemed as a tonic and purgative, being generally administered in the form of "black salt" in which it is combined with common and other salts. It is also used for washing the hair, in making ink, and along with some of the other myrobalans and iron filings in dyeing black.

In these forests it is gathered about January and one person
 1 Maund 1 maund. will earn about one auna a day selling
 —/3 2/— what he collects to *pansáris* at one
 maund for a rupee.

54. *Eriophorum comosum*. Wall: *blubar*. Commonly supposed to yield all the grass for rope so called and probably does yield part of it, (see *Andropogon* No. 8). It grows abundantly on the cliffs of the Siwálik, as well as, outside the forest, on the walls of the Fort at Nujeebabad &c.

55. *Erythrina suberosa*. Rox: *doklák, ringarí*. The "coral tree" easily distinguished by its corky bark with distant wide longitudinal wrinkles, and long prickles on the younger branches and its fine red flowers which appear before the leaves. Its wood is soft, white, and tough and is largely used for making the hoops of sieves (*chalni ke gherá*) for which purpose
 Cart load for 20 sieves, a log is first cleverly split into radiat-
 —/10 —/1. ing segments and then each of these
 into long strips concentrically.

56. *Falconeria insignis*. Royle *Khiina*. The timber of this small tree is occasionally used for domestic purposes but I hardly think it grows outside the Siwálik.

57. *Feronia elephantum*. Corr: *kait*. Small specimens of this tree, which has a dark bark, very much wrinkled and furrowed, grow in various parts of the forest, and it is not

uncommon, planted in the plains, but its timber does not appear to be valued here. It is white, with a tolerably close even fibre and in some parts of India is used for doors, rafters &c., In Bengal, a gum is collected from this tree.

58. *Ficus caricoides*. Rox: *anjirī*. A small tree resembling the cultivated fig-tree, common in the open plain, rare in the forest.

59. *F. cordifolia*, Rox: ? *kābra*, *khabar* (*gujjeon*) Bears a strong resemblance to both the *pipal* (No. 64) and the *pilkhan* (66). Its timber, like that of all the family is worthless, its leaves are given to elephants.

60. *F. Cunia*. Buch: *khenna*. Common in the lower and outer hills, and occasional at damp places in the forest. Its very scabrous leaves are in the Peninsula used in polishing cabinet-work, and in some parts of India, its fruit is employed medicinally.

61. *F. glomerata*. Willd: *gālar*. This tree which is common in the open plain, is rare—if wild at all—in the forest. Its fruit is greedily eaten by monkeys, and is used in curries &c., by the natives. Its timber is coarse-grained and brittle like that of the other figs, but as it does not readily decay under water, it is here (and in Central India) used for well frames.

62. *F. Indica*. Rox: *bargad*. The “banyán tree” revered by Hindū: as the female of the *pipal*, is abundant all over the forest. Its leaves are eaten by elephants, and although the timber of the trunk has the faults of that of the family,

Each —2/. the root stems are strong and elastic, and used as dandy-poles..

I have been informed that the red powder on the fruit is used for adulterating the *hamela* powder (No. 112) but I very much doubt the correctness of the statement.

63. *F. Oppositifolia*. Willd: *gobla*. A shrub which is occasional in the forest, and as far as I know, quite useless.

64. *F. religiosa*. *p-pal*, *peepul*. Not uncommon through-

out the forest, and there very often quasi-parasitical on other trees. Timber worthless.

65. *F. Roxburghii* Miq: *timla*. I do not think this tree extends outside the Siwāliks. Its timber is always small but is occasionally used for domestic purposes.

66. *F. venosa*. Ait. *pilkhān* (*pākar*). This handsome tree which is common, planted, in the open plain, occurs wild in the forest. Its leaves furnish elephant-fodder, and on the Peninsula, a red dye is made from the root, and bowstrings from the root bark.

67. *Flacourtia sapida* Rox: *bhanber*, *bilāngra*, *handāi*. This small tree, which has a light-ash-coloured, roughish bark, is perhaps less common than in the open plain. In the former I have observed it growing on the *pipal* where its seed had been dropped by birds. Its timber is useless, the ripe fruit is odible.

68. *Garuga pinnata*. Rox: *kharpat*. A rather handsome, tall tree whose old and blackened bark comes away in flakes leaving the fresh ash-coloured below. It is common throughout the inner part of the forest. The timber is little valued
 Cart load $4\frac{1}{2} \times \frac{1}{2}$ yd. but is used for planks &c., The bark is
 1/5. $\frac{1}{2}$. collected by tanners, and the leaves, which are exceedingly subject to galls, are used as fodder, whence the name *khar-pat*—grass-leaf.

69. *Glycosmis pentaphylla* D.C. *pīlilū pīlū*. A small shrub abundant in some places in and outside the forest, and only noted for its sweetly fragrant flowers.

70. *Gmelina arborea*. Rox: *kūmhār*. A fine tree, occasionally seen planted in the open plain, and common in the inner part of the forest. Its old, dark, outer bark peels off in broad irregular scurfy flakes, leaving exposed the new of a very light ash-colour.

The timber is very little valued here, except for making

s. Mand. large bowls, the yokes of ploughs &c., but
 1/— it is tolerably close-grained and elastic, and

it is said that very few timbers possess so much strength with so much lightness. Baker found a six feet bar, two inches square, break with 580 lbs. It is durable, does not warp, and is not obnoxious to the attacks of insects. In the Peninsula it is employed in turnery, and for making carriage panels, drums, chairs &c.

71. *Grewia elastica*. Royle. *phālsā*, *pharsiā* (*dhāman*) common all over the forest, but never attains any great size. Its timber is like that of some others of its class, tolerably close grained and elastic, and is in some places, employed for making carriage-shafts &c.

Its fruit is eaten by natives, and reckoned "cooling."

72. *G. oppositifolia*. Buch: *bhenwal*, *bhimāl*. Barely extends outside the Siwāliks. In the hills its bark fibre is much used for making an inferior kind of rope.

73. *G. sapida*. Rox: *pharsia*—A small bushy species only two or two and a half feet high, with edible fruit; abundant in most open places throughout the inner part of the forest.

74. *G. scabrophylla*. Rox: *banphālsā*. Rather taller than the last, and with the largest fruit of any of these *Grewias*. It is edible and said to be sent from the outer Himalaya to the plains under the name of *goorbhelee*. I do not think however that it extends outside the Doons, though it is common in them.

75. *Grislea tomentosa*. Rox: *dhārla*. Extend only to the
 20 Seers. outer edge of the Siwāliks. It has a very
 1/— handsome appearance when in blossom, and
 its red flowers (*dhā*) are exported as a dye and medicine.

76. *Guatteria velutina*. Wall: (*Unona*. Dun:) *gīdar rukh*, *gūiyasāl*. Frequent but nowhere common throughout the inner and middle part of the forest. Its wood is not valued, though some of its congeners furnish very useful timber in other parts of India.

77. *Hastingia coccinea*. Rox: *kabbani, गया*. A fine red flowered shrub, which hardly extends outside the Siwāliks.

78. *Helicteres Isora*. L. *macrophala*. A large shrub abundant throughout the middle and inner parts of the forest. Its corkscrew-like fruit is used largely by the natives in colic, 20 Seera. dysentery &c., probably on the doctrine of signa-
1/- tures which natives believe in as thoroughly as did our ancestors 300 years ago.

79. *Hiptage madablota*. Geert: (*madmāl*). A remarkably handsome climber which is very rare outside the Siwāliks.

80. *Holanpena antidysenterica*. Wall: *kūar, moriā*. A tall shrub, abundant all over especially in the inner part of the belt. Its wood is white, soft, and fine-grained and though rather more knotty than the *dūddhi* (No. 137) it is largely
Cart load 10 maunds. used for carving tobacco-boxes, and
—/10 1/- spoons and forks for Mussalmāns.

There is inextricable confusion in the books between this plant and *Wrightea antidysenterica*, as to which of them yields the febrifuge bark called *conessi* in Southern, and *indarjan* in Northern India. The bark of this plant is undoubtedly used by the herdsmen with that of *Rottlera* for fever, but I cannot find that it is collected for export, or is known by the name *indarjan*.

81. *Hymenodictyon excelsum*. Wall: ? *beram, genta (bhoulun)*. A large tree with a dark bark, very corky and much gnarled, not uncommon all over. The timber is white, soft and little valued, but near the Sutlej appears to be made into sword-scabbards. In the Peninsula the bark is employed in tanning.

82. *Kydia calycina*. Rox: *pattrā, paldo*. A moderate-sized bushy tree, with smoothish, ash-coloured bark, occasionally seen planted in the open plain, common over the inner half, and abundant in the inner most part of the forest. Its wood is little valued, but is occasionally employed for making ploughs and spoons.

The bark (*chuklá*) has much viscous juice and is taken to the plains in large quantities to be used in clarifying sugar.

83. *Laguströmia parviflora* Rox: *bákú* (*dhánvā*). A fine tree with a columnar trunk, the dark old bark of which peels off in thinnish scales from the light grey beneath. Is common over all the inner portion of the forest, and apt to be confused with *Conocarpus* (No. 40. 9. v.). Its timber is white,

Cartload $4\frac{1}{2} \times 1\frac{1}{4}$ yds.

—/8

1/8.

close-grained, straight fibred and elastic, and is employed for building, and for ploughs, hatchet-handles &c. In Bombay it is extensively used in the dock-yards and I am told that by the Meerut coach-builders for buggy shafts it is reckoned second only to *sūndr.* (*Hieritiera minor*, L.) I may note that the latter, which is said to give name to the Soondarbunds, and of which large part of the supply for coach-builders in the N. W. P. comes up as masts in Calcutta built boats, was the toughest wood experimented on by Baker; a six feet bar, two inches square only breaking with 1030 lbs.

84. *Leea aspera*. *kumálá*. An herbaceous plant with an edible fruit, not common outside the Siwāliks.

5 Seers.

1/—

85. *Luffa amara*. Rox: *bindál*. The fruit of this bitter wild gourd is collected for use in veterinary medicine.

86. *Melia Azadirachta* L. (*Azadirachta Indica*. A. De. Jus:) *nīm*, *neem*. This well known small tree which is common planted in the open plain, is doubtfully wild at one, or two places in the forest but not in sufficient quantity to be economically of value. In Bengal, its timber is said to be especially used in the manufacture of idols as it is so bitter that no insect will attack it.

87. *Mimosa rubicaulis*. Lam: *kīnglā*, *kīngreā*. A straggling very prickly shrub, not uncommon in the inner part of the forest.

88. *Moringa pterygosperma*. Gaert: *senjā*, *soojnā*. The "horse-radish tree" is common planted in the open plain and

abundant wild all over the forest. The natives say its wood "is not fit even for burning" but its fruit is eaten, cooked as a vegetable or in curries. From incisions in its bark a gum exudes plentifully within a day or two; this is collected for

1. Maund	16 seers.	export to be used in medicine. Here
—/4	1/—	one man can gather 5 seers a day, for

which the dealers' agents give him—/1.

89. *Morus parvifolia*. Royle. (*tootree*). The small wild mulberry tree of the open plain, is very rare or absent in the forest.

90. *Nauclaea cordifolia*. Rox: *haldū, huldoo*. This magnificent tree, the trunk of which is frequently buttressed like that of the semul (No. 20) though not so abundant here as to the east of the Ramgunga, is or has been common over all the inner portion of the forest. Its smooth-fibred, yellow timber is not much valued, but is used

Cart load	cart load.	for planks, boxes, keels of boats, combs,
—/8	3/—	writing-tablets &c.

91. *N. parvifolia*. Rox: *heim, kangei*. This tree which is occasionally seen out in the open plain, and whose dark smoothish bark peels off in irregular patches having the fresh light grey exposed, is not uncommon throughout the forest.

Cart load	10 maunds.	Here the timber is used for similar pur-
—/8	1/—	poses to that of the last, and is not

much valued.

92. *Nerium odorum*. Soland: *kaner*. The Oleander, well known in cultivation seems here to find its eastern limit for growing wild near the plains level. It just touches the skirt of this district at the mouth of the kothari Doon in which it is abundant. Further east, it is only found at some distance within the hills in Kumaon and Nepal. Far to the north-west again in the Upper Punjab, it is not uncommon by streams in the plains.

Its bark &c., are used medicinally.

93. *Bœhmeria salicifolia*, Royle: *tsārdā*. This shrub, the

fibre of which is used for making ropes, hardly extends outside the Siwálíka.

94. *Nyctanthus arbor tristis* L. *kiera* (*harsinghár* of native gardens) common on the Siwálíka, but hardly extends beyond their skirts.

In Bengal the rough leaves are used for polishing wood; and in most parts of India the flowers furnish a perishable yellow dye but they do not appear to be collected in the forest.

95. *Odina Wodier*. Rox: *jingan*. This quick-growing tree, which attains a large size, and whose dark bark splits off in thin scales, is common all over the forest, especially in the inner part. The reddish heart-wood is said to be tolerably durable, but the timber generally is little esteemed and is chiefly used for planks, sides of cots, drums, and in other parts of India for sword-scabbards.

Large quantities of gum (*jingan* or *kanni-ka gond*) exude spontaneously from the bark of this tree, and much is collected for export. It is used by dyers, cloth-printers, for making ink, and in medicine, and is practically divided into two kinds. These are 1st the white, generally called *kanne* of which a

1. Maund	10 seers.	man can gather one seer a day, to be
—/4	1/—	sold for about half an anna (?) to the

dealers; and 2nd. the black, *jingan kagond* which consists

1. Maund	15-32 seers.	nominally of what has fallen to the
—/3	1/—	ground, but is almost invariably mixed

and sold with that of *Conocarpus* (No. 40 9. v.) Of the black gum, one man can collect 5 seers in a day, which brings him in—/1. Both are gathered about April.

96. *Orthanthera viminea*. Wight. (*chupkeea*). A bush common in stream-beds in the forest, the fibre of which has been recommended for cordage.

97. *Aralia digitata*. Rox: (*Parateopia venulosa* W. and A.)?—A handsome climber which occasionally occurs.

98. *Pentaptera tomentosa*. Rox: *sein*, *asin* (*sáj*). This

fine tree which has a dark bark, rough and longitudinally furrowed, not unlike that of *adi*, is or has been common all over the inner part of the forest. The timber is reddish, tough, strong and durable; sp. gr. 986; a six feet bar 2 inches square was found by Baker to break with 903 lbs. and it was the most elastic of all the woods experimented on by him. It is employed for general purposes here, and in the Peninsula carriage-shafts are made of it. In some parts of India, but not here, the bark is used by dyers.

99. *Phoenix acaulis*. Ham: *kajūrī*. The stemless palm is abundant in the open parts of the inner half of the forest. The stalks of the fruit-bunches are so short, that the small dates are half-buried in the earth. The ripe fruit is red, sweet, and edible. In Behar, an inferior rope is made from the bruised leaves. Royle was, I venture to think, mistaken in considering this to be merely a variety of the next species.

100. *P. humilis*. Royle. *chhota khajūr*, *khajūrī*. This, whose stem grows to 5 or 6 feet, is common in the Siwāliks. The ripe fruit and the flower, neither of which have I ever got, would go some way to settle if it is the same as the *P. farinifera* of the Peninsula, or merely, as I suppose, the wild form of the following. —

101. *P. sylvestris*. Rox: *khajūr*. This tree though common about some villages and in certain soils in the open plain, appears to be no where truly wild near this district, and it hardly, if at all, enters the forest.

The trunk decays rapidly when exposed, but is used for indoor beams and supports, and in many parts of India for water channels.

The leaves are made into mats (*chutāi*). The juice (*tār*) is in spring tapped by means of an incision below the tuft of leaves and is used as a beverage, but no sugar is here, as in Bengal, made from it. The fruit is edible though it cannot be compared with the dates brought from Affghānistan.

102. *Pinus longifolia*. Rox: *ch r, cheer*. Does not descend below the upper part of the Siwāliks, so its qualities need not be entered upon here.

103. *Potamogeton crispus* L. *kareli senvāl*, and *P. gramineus*, L? *bāliyā senvāl*, are both collected largely in canals &c., in the open plain and in the Tarāī, to be used in the clarification of sugar.

104. *Premna mucronata*. Rox: *bākr, bakār malhá*. This tree is occasionally seen at villages in the open plain (and there sometimes called *basota* from its strong smell), and is not uncommon all over the forest. It never grows to a large size but its timber appears to be hard and strong and is sometimes used for making cart wheels.

The milk of the bark is applied to boils, in domestic medicine, and its juice is given to cattle for colic (*makrá*).

105. *Pueraria tuberosa*. D.C. *sarār, sarvāla*. A climber which is not uncommon beyond the skirts of the Siwāliks. I cannot find that its immenso tubers are collected here, but from various parts of the hills they are said to be exported as *bildā kand* to be used in cataplasms &c.

106. *Patranjiva* Roxburghii, Wall: (*jīyapota, pūtra vij.*) This, which in other more southern parts of India, grows to be a large timber-tree, the close-grained wood of which is employed by turners, is found wild in one or two places in the forest, and I have seen it, planted, in the open plain.

The Fukir's beads made of its hard seeds however appear all to be imported from below.

Randia. The native names of the species of this genus are very much confused, consequently the uses of their fruits are noted doubtfully:—

107. *Randia dumetorum* Lam.: *mendphal*. Common all over the inner part of the belt. It never grows large, and its wood is only used for fuel. The fruit when young and fresh, is employed for poisoning fish, and when ripe is collected for

1. Maund. export. It is used in veterinary medicine and
 $\frac{1}{4}$ given as an emetic to men and applied to boils.

108. *R. longispina*. D.C. *pāddā* (*thanella*). This appears to be less common than the last. It grows to a larger size and its wood is made into yokes &c.

The fruit appears to be collected as an edible, and to be
 2. Maunds. $\frac{1}{4}$ —? applied to boils.

109. *R. uliginosa*. D.C. *thanella* (*mendphal*). Common throughout the forest. The wood is close-grained and hard, but has no special use. The fruit is employed to kill fish, and in medicine, and is also eaten.

110. *Rhus acuminata* D.C. (*Pistacia integerrima*, H.f. and T.) *kakkar*. Young specimens of this tree, which produces 'zobra-wood' the handsomest of the furniture-woods of the N. W. Himalaya, occasionally extend just to the skirts of the Siwāliks. No where within my knowledge is it an abundant tree and the demand for its timber has rendered it exceedingly scarce over this part of the outer Himalaya.

Large horn-like excrescences (*kākrasinghī*) which are found on its leaves, are used in medicine.

111. *Robinia macrophylla*. Rox: *gaujā*. A fine luxuriant climber which is abundant along the innermost part of the forest, and which I have occasionally found in jungles in the open plain.

112. *Rottlera tinctoria*. Rox: *rāinys kamela*. This large shrub is abundant throughout the inner half of the belt. Its wood is said not to be obnoxious to the attacks of worms, but is always small and is not valued..

3. Maunds. $\frac{1}{4}$ — The bark is employed by tanners. The red powder found on the capsules, is collected in large

1 Maund $2\frac{1}{4}$ —5 seers. quantities, to be used as a vermifuge
 $\frac{1}{4}$ — $\frac{1}{4}$ — and as a valuable red dye for silk. The ripe capsules are gathered off the bushes about March, and after being allowed to lie in heaps for a few hours, are rubbed and kneaded with the feet on the ground, to remove the pow-

der,—the broken capsules being then separated by winnowing, sifting and picking. One man will collect about a seer of the powder a day, which is bought by the dealers at 1/— for 5 seers. The above process would quite account for the commercial *kamela* not being very clean; but besides this, although the Boksas who gather it deny any adulteration whatever on their part, it is said never to reach even the Nujeeabad market in its comparatively pure state. The substances added are stated to be the powdered bark of *Casaria* (No. 30) and the powder of *Ficus Indica* (No. 62.) On the other hand, *kamela* itself is said to be used to sophisticate arnotto.

113. *Saccharum*. Among the gigantic grasses of the forest and Tarāi, there are many species of *saccharum* known under the somewhat fluctuating names of *kāns*, *sarar*, *mūnj*, *kilik* &c. &c. I shall not attempt here to disentangle these, but be content with mentioning that the principal useful species

Various products from —/8 a cart load, *sar* for thatch to—/2 a maund for *sūk*. appear to be *S. spontaneum*, L., *S. Sara*. Rox: *S. Munja*. Rox: and *S. semide*

cumbens. Rox: these, and perhaps some others supply from their culms, materials for screens, chairs, pens, brooms, and *śirkī*, and parts of their leaves are used for making rope, thatch &c.

114. *Salix tetrasperma*. Rox: *bed* (*bhynsh*). This, the common Indian willow, occurs occasionally by stream-beds but is nowhere found in great abundance. I know of no special use to which its timber is put.

115. *Schleichera trijuga*. Willd: *gosam*, *gausam*. This tree which is at times seen, planted, in the open plain, is not uncommon in the inner part of the forest, where however, much of it has been cut. Its wood is red, very hard and heavy,

3 × ½ yd. and its special use is for making the crushers of 1/— sugar, and oil-mills; and in some parts of India, screws are made of it. The fruit is edible, and in the Deccan is made into pickle.

116. *Scilla Indica*, Rox: *kīndrī*, *kānda* (*iskā*). A slender Liliaceous plant with a large bulbous root. The latter is collected in the forest in large quantities to be used by weavers for giving body to their thread. It is also employed medicinally, and being closely allied to is almost a perfect substitute for the squill of European pharmacopeias.

117. *Semecarpus Anacardium*, L. *bhilāwa*. The "marking-nut tree" hardly extends outside the skirts of the Siwaliks. It has a peculiar, smoothish, dark bark furrowed with shallow wrinkles, and its wood is soft, white and valueless.

The fleshy red calyx of the fruit is eaten, but in some people is said to produce swelling of the body. This effect is also sometimes attributed to mere contact with this as with some other members of the same family. The nuts themselves are

16. Seers. collected for export, being used as an ingredient of ink, and given as a medicine to elephants.
1/-

118. *Shorea robusta*. Rox: *sāl*, *saul*, *handār*. I shall allude more fully hereafter to this tree which produces the second-best timber in India. Outside the Siwaliks it only exists in restricted patches, and does not grow luxuriantly. The timber is reddish coloured, close-grained, even-fibred and heavy, and is stronger than teak, but is said to be less durable.

(Slaspar. Its sp.: gr: is over 1,000 and Baker found
1/8 to 2/- a six feet bar two inches square break with
1,238 lbs. With careful seasoning it is an invaluable timber
for all purposes requiring strength, and excels all others for
gun-carriages. Crushers of sugar-mills are sometimes made
from it but are said to last only half as long as those made
of tamarind.

Its bark is occasionally employed by tanners and a resin (*sāl*) exudes from its bark which is burned as incense in Hindoo temples, (and in ship-building yards is used as pitch.) This resin does not appear to be abundant or to be collected

3. Seers. even in the Doons near this, and the bazārs
1/- are said to be supplied from "the East." From

the resin, in Shahabad, an aromatic oil (*choya*) is procured by dry distillation.

119. *Sizygium Jambolanum*, D.C. *jáman*. (and a variety *jamáwa*?) a tree with a smooth, light coloured bark, common, planted in groves in the open plain for its fruit, and not uncommon in the forest. Its timber is tolerably good, $4\frac{1}{2} \times \frac{1}{4}$ yd. —/8. and used for planks, and domestic purposes.

In Bengal and the Peninsula, the bark is used to dye brown, and in Bombay a gum like kino is extracted from the bark.

120. *S. venulosum*, Royle? *rái jáman*. I hardly think this handsome tree grows outside the Siwāliks so far west as this.

121. *Solanum verbascifolium*, L. *aseda* (*asheta*). A large shrub with curious mealy-looking leaves, which is very rare outside the Siwāliks. In Southern India the plant is cultivated for its berries which are used in curries.

122. *Spondias mangifera*, Pers. : *ámára*, *ámabára*. Rarely found outside the Siwāliks and innermost part of the belt.

The timber is worthless. The fruit which is compared to a particularly bad turpentine mango, is eaten by natives and made into pickle (*khatái*). Various parts of the tree are in the South of India used in medicine.

123. *Sponia Wightii*, Planch : *jaūn* (*khusaró*). A small tree with very rough leaves common but only locally in some parts of the forest, and mostly found near streams. To the eastward and in Southern India, the leaves are used instead of sand-paper to polish wood and horn.

124. *Sterculia villosa*, Rox : *ūdāla*. A small tree abundant at some places in the innermost part of the belt. Here, as elsewhere, a strong rope is made from the fibre of its bark, after a process of steeping and beating. In the South of the Peninsula, elephant-ropes are made of this, and in Bombay the fibre is employed for making bagging.

125. *S. Wallichii*, *bodūla*. Hardly extends outside the Siwāliks. Ropes are made from its bark also.

126. *Tamarindus Indica*, L. *imk*. The tamarind tree has properly speaking no business in a list of the plants of this forest as it no where grows wild near this, but on account of the excellence of its timber for special purposes it deserves some mention. The tree is well-known in cultivation, being grown chiefly on account of the pulp of its fruit which is used both as food, and in medicine.

The timber is finely veined, hard, heavy, and strong, and is applied to various uses, such as for making naves, clod-crushers, door-frames &c., but is particularly valued as the *Kolhu* up to 5—. best and most lasting wood for both parts (*chāran* and *kolhā*) of sugar and oil-mills.

127. *Terminalia Bellerica*, Rox : *bahera*. A large tree with bark tessellated by longitudinal and transverse furrows and cracks; not uncommon throughout, and most frequent in the inner part of the belt.

Cart-load $4\frac{1}{2} + \frac{1}{4}$ yds. The timber is used for planks &c.,
—/5. $1\frac{1}{2}$. but is not valued.

The fruit which appears to be a favourite food of the Senmo-
 $1\frac{1}{2}$ maunds. 1/— . *pithecus* (*langūr*) is largely collected, chiefly for use in dyeing and tanning. The leaves also are employed by tanners, and in various parts of India different parts of the tree are used medicinally.

128. *T. Chebula*, Retz : *har*, *harrā*. Not uncommon in the inner part of the forest; the timber is of no value.

The fruit, which here is larger and finer than that which comes from the hills, is collected for export, to be used in medicine and by dyers. One man will collect one, or one and a
1. $1\frac{1}{2}$ maunds, 1/— . half annas' worth a day, the dealers buying from him at the rate of 4 or 5 *kacha* maunds for a rupee.

129. *Tetranthera apetala*, Rox : *meda lakri*. A small tree
12 maunds 1/— . common all over the forest, timber of no value. The astringent fresh bark is applied to bruises,
1 maund —/1. 1 to $1\frac{1}{4}$ and it is exported largely for use in
maunds, 1— . medicine.

130. *T. Roxburghii*, Nees: *masūr* (*mada lakri*). Occasional throughout the forest. There is some confusion about these two species but I think the medicinal bark has been assigned to its proper source.

131. *Trophis aspera*, Willd: *siora*, *kar chamra*. A small, scraggy looking tree, common wild in the open plain and occasional in the forest. Its timber is worthless and here no part of the tree appears to be utilized, but in Southern India its juice is applied medicinally and the rough leaves are used to polish ivory.

132. *Typha latifolia*, L. *patera*. A tall bulrush, abundant in marshy places. Its leaves are collected for the manufacture of coarse mats (*boriya*).
Cart-load —/8.

133. *Ulmus integrifolia*, Rox: *papri* (*kunjū*). A fine tall and handsome smooth barked tree, with dark foliage; sometimes planted in the open plain, and common in the inner part of the forest. Its timber is light, white, and liable to $4\frac{1}{2}+1\frac{1}{4}$ yds. 1/2. split, and its chief special use here is for making spoons. In Southern India it is employed for making carts, door-frames &c.

134. *Vitex negundo*, L. *shamālū* (*nawree*). A tall shrub common in the forest as in the open plain. Its wood is too small to be of use, but its twigs are employed for wattling &c. The fruit is said to constitute the medicinal *filfil bari* of the bazārs, and in Southern India various parts of the plant are employed in medicine.

135. *Wendlandia cinerea*, Wall: *pudhārā* (*chilkiyā*). A large shrub hardly extending outside the skirts of the Siwālika. Its timber is said to be useful in carpentry.

136. *Wrightea mollissima*, Wall: *dādhi*. A large shrub not uncommon (but much of it cut), in the inner part of the forest. Its wood is white, fine grained, Cart-load 10 maunds —/6 1/— free from knots and easily worked, and is much used by carvers for making bowls, plates, &c.

The following belong to a genus of which the Indian spe-

cies are as yet somewhat undecided, but I think I have not gone far astray in arranging them provisionally as follows:—

137. *Zizyphus Jujuba*, Lam : three varieties.

a. *gharberi*. Small and bushy, one of the most abundant wild shrubs of the open plain and common also in the clearer parts of the forest. Its wood is never large enough for aught but fuel, and its small red fruit is not edible.

b. *khalis*, *ghuter*, *beri*. and c. *katber*, (*ghuter*), both attain a considerable size and are not easily distinguished. They approximate the cultivated variety of the plant, the fruit of which is much relished by natives. These are common throughout the

10 maunds 1/— forest. The timber is tolerably hard and strong, and is made into churn-sticks (*rei*), feet of cots, crushers, bathing wooden shoes &c. In Southern India it is used for saddle-trees, and has been recommended for sleepers, but, if correctly it must attain a much larger size than it does here.

Cart-load	3 maunds	The bark is much used by tanners, and lac (<i>lák</i>) is collected from the tree, to be employed in dyeing.
—/10	1/—	

1 maund 1/4.

138. *Z. mummularia*, W. & A. *ghar bari*. Very similar to variety a. of No. 137, and found along with it.

139. *Z. Oenopia*, Mill. *mako*, *bamolán*. Abundant in the open plain, very rare in the forest. Its wood is small and only fit for fuel; the fruit is eaten, and its juice used in medicine.

140. *Z. vulgaris*, Willd : ——— ? A large shrub, occasional in the forest.

Besides the Forest rates payable to contractors on timber &c. the produce of certain trees, there are some general rates, such as on each cart load of firewood $\frac{1}{4}$, of charcoal $\frac{1}{10}$, on each rice-pestle (*músal*) a half anna, and on each oar 3 pice. Though these are apparently of minor importance, the first two probably contribute a considerable part of the revenue derived from the forest.

There are only I think two forest exports of commercial value to be mentioned here on which rates are levied, but which not

being the produce of any or of special plants, are not included in the above list. These are lime, and wax (with honey). The *khara* earth from which lime is manufactured pays $\frac{1}{3}$, the lime itself $\frac{1}{6}$, and the limestone pebbles from which lime is burnt, $\frac{1}{4}$ a load, but there is no reason to suppose that any very extensive manufacture of lime is carried on in, or with materials drawn from the forest. A good deal of wax and honey is collected, the forest-rate paid on the latter being $\frac{1}{4}$, and on the former $\frac{1}{4}$ a man.

Gold washing was I believe at one time a source of revenue to the district as it was regularly carried on both in the Ramgunga and in the Ganges, the right to wash gold in each being leased. But it was never very remunerative to the washers, and if any gold is got now from the sand of these rivers within the bounds of this district, it must be of very limited amount.

In touching more particularly on some of the members of the preceding list, I may pass over without further remark all the fruits, drugs, dyes, tans and gums, which are yielded by trees and other plants growing here. Nor need I do more than give collectively the names of plants yielding fibre, viz: *bábar* (Nos 8 and 54), *múlá* (15), *bhenwal* (72), *túsárá* (93), *múnj* (113), *udála*, (124), and *bodála* (125), as, none of them except the *múnj*, grows or is collected in very large quantity within our limits.

Bamboo has an intermediate place, as it can hardly be reckoned a minor product, nor, though mostly used for construction, is it, strictly speaking, timber.

The best charcoal for furnaces &c, is produced by *khair* (2) and *bel* (6); *behera* (128) and *ber* (138), furnishing a somewhat less valuable article, while the light charcoal of the *dhdák* (23) and *binda* (39) was in repute in former days when the manufacture of gunpowder was permissible.

The creed of the natives as to the most important timbers, is summed up in a local rhyme.

"*Sāndan, shisham, sonā sāl*
Jab chhil hota, nikle lāl."

Which may be paraphrased thus

"*Sāndan, shisham and sāl* so sound,
 Redness follows the axe all round."

Perhaps as regards redness, strict truth has been here sacrificed to sound, but for quality of timber, it might not have been easy to make a better selection. Unfortunately for the Bijnour forest none of the timbers for excellence is produced in large quantity within its limits.

Sāl (118), THE timber of the forests of the N. W. Provinces, at some distance outside the skirts of the Siwāliks here, as all along this tract for hundreds of miles to the eastward only exists in isolated strips and patches. In these the trees never grow to any great size, but appear to be arrested at an early stage of their development, when, according to several authorities, they become rotten and hollow without apparent cause.

In the Bijnour forest there are three principal strips of *sāl*; one in the east beyond Kehur, another towards the centre in the Burrapoorā district, and the third and largest to the westward in Chandee. In the last the trees appear to thrive better than in the other two places, in accordance with what has been observed elsewhere, viz: that *sāl* prefers a high, dry and gravelly site. In these three situations as in other places the tree grows gregariously, and very large numbers of young plants may be observed in some parts. An immense proportion of these however must perish from the jungle-fires by which the tall grass is burnt down several times each year, to allow the fresh young herbage to come up for pasture. Whether or not the statement be true that the young trees absolutely rot at a certain stage, it is certain that for many years no *sāl* larger than to form moderate-sized poles (*balli*) have been taken from this forest.

Howing are the other trees furnishing the more use-
 derably hard or strong timbers which are found here;

khair (2), *bel* (6), *tām* (33), *kām* (41), *lādāra* (42), *sāndan* (46), *sisū* (47), *aonla* (53), and *gawgam* (115). None of these requires further notice than has been already given as to their qualities and frequency except *tām* and *sisū*. Of the former almost none above the size of the smallest sapling are now to be seen in this forest, as the worth of its wood prevents it from attaining any size where any thing like indiscriminate felling is allowed. Of *sisū* there are extensive groves of young trees along the banks of streams and stream-beds and on islands; just as on the Chāndnee chauk islands of the Sardah and along that and other rivers in Oudh this tree grows in great quantity in such places here. But here hardly a tree of any size is to be seen, whether from the fact that the constant shifting of the beds by freshets prevents the saplings from ever attaining full growth, or because they are invariably cut down so soon as they become at all fit for use, it is difficult to say. Probably both causes unite to account for the phenomenon but I believe considerable effect must be attributed to the latter, seeing that those trees which do escape being drifted away by floods, must, if left alone, attain at least the respectable size of those in the open plain which grow under less favourable circumstances. At the same time it may be that the inhospitable sub-soil has a peculiarly deleterious effect on this tree. Just as the climate here outside the Siwāliks has on the *sāl*.

The following are the trees which so far as regards their uses here, must be reckoned of inferior or third-rate quality for general purposes, although some of them are considered valuable in other parts of India, *pādal* (19), *semal* (20), *dhauri* (40), *kharpāt* (68), *kūmhār* (69), *beram* (81), *bāklī* (83), *huldū* (90), *keim* (91), *jingan* (95), *sein* (98), *jamun* (19), *papri* (133), and *beri* (137). The frequency or rarity of each of these with their qualities, has already been sufficiently noted in the general list. *Kūar* (80), and *dūddhi* (136), from their colour, texture and softness, are useful for wood-carving, and *doldāk* (55) is of value to the sieve-maker.

The only other timber I need here specially mention is the ebony *tandā* (49). It is very difficult to get exact information on such a point from natives, but I have no doubt but that this tree is gradually getting worked out in the Bijnour forest, although the manufacture of the boxes &c., which are made from it is confined to one place (Nugeena) and their sale is by no means actively pushed.

Besides the timber and minor products there are two sources of forest revenue which require notice. One of these consists of the fees for wild elephants caught (50/ on each) which produce several hundred rupees a year, and the other, of grazing-fees, which are of considerably greater importance. The grazing-rate charged by the contractors is 10/ a year, for 100 cattle, 20/ for 100 buffaloes and 4/ a year for a herd (i. e. as many as are kept under one *chhappar*) of sheep or goats; a fee of from one to four annas is also imposed on each hide exported. I have no certain information as to the annual amount that is raised from this source, but it must be very large from the great numbers of cattle which are brought from both hill and plain, especially the former, to graze during the cold season. Their number is at present on the increase owing to the shutting of some of the Doons. The *paháris* who bring their herds down for grazing purposes are mostly from Kumaon, the cause of which is said to be that cattle-raising is there more attended to, while there is less extent of waste land than in Gurhwál. The principal product of this grazing is *glee*, which is exported hence to the plains in very large quantities, being bought upon the spot by dealers.

Of the 260,000 acres (including a few thousand acres of cultivated land) contained in the Bijnour forest, nearly 70,000 are in private hands. This state of things was partly unavoidable but the larger proportion of the 70,000 acres consists of that part of the Kehur estates which became forfeit after the mutiny. This might still have remained Government property had we not here done as on the Nepal frontier,

though on a very much smaller scale, in giving in rewards to those who doubtless deserved them well but might have been equally well-satisfied with *jaghirs* elsewhere, land we may one day wish that we had kept.

The management of most of the forest which remains to Government having hitherto been conducted on the plain principle of "clearing as rapidly and profitably as possible" has been simple enough. The Chandee forest i. e. the extreme North-west corner of the district lying to the west of the *Peelee Kas nuddes*, including some outlying spurs of the Siwāliks, and containing some 50,000 acres, has for special reasons been for the last 8 or 9 years, under charge of the Kumaon forest officers, and there *all* wood cutting has been nominally prohibited, only bamboos and minor produce being allowed in the contract. But elsewhere the system has been that the forest in several segments has been put up to auction annually, the parties leasing it for the year having the right to all spontaneous produce and being authorized to "cut and sell" all they can (*all* excepted in one segment.) What is realized by them for timber, bamboos &c., is thus theoretically construed to be the *price* of these articles, but in reality is levied and considered as a rate or due paid to the contractor by those who cut and remove timber and collect minor products, (or graze cattle) in the forest.

It is possible that with the non-capitalist natives who at present generally lease the forest, it might not be easy to work any other system; but the plan might be tried of letting it in much smaller segments, or, as is said to be the case in Chandee just now, monied men might be found to take the contracts. In either case such rules might be adopted and insisted on as would make the lessees work the forests systematically, so as to ensure not only the present but the prospective good of Government, the public, and themselves. The frequent changes of lessees, and sudden annual fluctuations of rent, do not indicate a very healthy state of things as to these leases.

The amount for which all the forest now in the hands of Government has let during the last few years has varied from 15,000/ to about 32,000/. The larger amount however must be considered quite abnormal, as in the years approaching to that sum, viz: those immediately succeeding the mutiny, when the forest had had rest and could of course stand a larger drain, not only do the contractors appear to have done their best to ruin it, but some of them also to ruin themselves. The aggregate amount of the contracts is now about twenty to twenty two thousand rupees, which appears to be nearly what the forest in its present state and on the present system will pay.

A tendency to increase of rent for some parts of late years chiefly depends on the fact that some of the forests of neighbouring districts have recently been closed, so that there is a greater demand for especially bamboos from these and others which are still open. It is as yet very doubtful if the bamboos of (the neighbouring strip of Gurhwāl and of) the Bijnour forest can stand the increased drain. In former years there seems no reason to doubt that each season's growth of bamboo was equal to supply the annual loss from cutting, except in Chandee of which the bamboos are immeasurably more valuable than in any other part and where cutting seems to have been terribly overdone in the years above alluded to, and it will require a year or two's further experience to determine whether or not this may be the case, with the present increased demand. In the eastern and central parts however the quantity of bamboo is comparatively trifling, as there the boundary line of the district does not follow that of the skirt of the Siwaliks beyond which this plant generally extends to only a short distance, but follows the line of the main longitudinal sub-Siwalik road, which runs from Kalee doongee via Chilkiya and Lāldhāng towards Hardwār. Near Chandee again there is a great deal of valuable bamboo, for it not only contains the outliers of the Siwaliks already mentioned, but this part seems

to be peculiarly favourable to the growth of the plant which may be found in some quantity in the rough ground near the Ganges towards Amsot, far outside the hills. It is note worthy that not only Bamboo which is the most productive item in this forest, but sal the best timber of the Northwest, and Teak, the most important timber-tree in India or perhaps in the world, should all be gregarious in their growth.

It were out of my province to enter into much detail as to what I may conceive to be the best system of management of the Bijnour forest, but there are several aspects of this question which obtrude themselves so strongly that I cannot quite pass them over.

During last cold weather in trudging on foot many miles through this forest, I could not but see that the great cause of distinction of the young *sal* and other young trees more or less valuable, arises from the frequent annual conflagrations which in their devastating progress not only burn up the tall harsh grasses as is intended, but destroy hundreds of tender saplings, as well as scorch up much of the foliage of and thus render unhealthy many of the larger trees; and I was corroborated in this view by Dr. Brandis when I subsequently met him in the forests of the Doons near this. But as Hooker has truly remarked, "whether as a retainer of miasma shelter for wild beasts both carnivorous and herbivorous alike dangerous to man, or from their liability to ignite and spread destruction far and wide, the grass jungles are most serious obstacles to civilization," and they must be kept down somehow and to these reasons we have to add the still more pressing utilitarian one that the young herbage must be allowed to come up as pasture, especially when we consider that the amount raised from pasture-dues probably bears a very large proportion to the Forest-rates proper. This is indicated by the fact that a few years since (about 1,846) in the Kumaon Bhābur, the latter exceeded the former by only a few hundred rupees (9756 to 8973). It is only perhaps in

isolated and special situations, as in the neighbouring small Doons where the growth of *sāl* &c. is really of immense value, that it will pay to exclude the agriculturist and herds-men altogether, and thus lessen the probability of fires, as well as prevent even the chance of indiscriminate cutting, so making sacrifice of a present minor advantage for the sake of future gain. At the same time it appears not impossible that means might be adopted to render these forest-fires less destructive to saplings and trees than they now are.

Another and more practicable improvement which suggests itself is this. If it will in the end be a saving to keep a few men on the Eastern segment of the forest when alone (to the east of Peelee Rao) there is any conservancy establishment, might not similar conservation,—with of course a corresponding restriction of the lease,—be extended to some other places, where if the quantity of *sāl* is much smaller, the establishment required would also be less extensive? And this not with the futile hope of even the third generation hence—(the tree in all probability nowhere attains any very great size in less than several scores of years,) cutting in these extra-Siwalik strips noble *sāls*, monarchs of the forest, such as possibly the last generation removed from the outer skirts of these hills, and the present is cutting within them, but merely for guarding the saplings till at 12 or 15 years they be fit to furnish good poles and spars. One is the more inclined to believe it worth risking the small expense a few men for this purpose would entail, from being aware that some years since many thousands of rupees worth of *sāl ballis* were in one season out by a sharp contractor from similar strips in this very forest, and from having seen hundreds on hundreds of *sāl ballis* brought into a neighbouring station near which all *sāl* cutting is “strictly prohibited.”

A larger and fully more difficult question remains for discussion. Even if the present system of managing this forest, so as “to clear it as speedily and profitably as possible,” has

hitherto been the best possible, will it henceforth be so? And this includes two subjects of very considerable importance viz. 1st. does clearing imply that cultivation will follow? And 2nd, apart altogether from the larger and more valuable timber-trees, is not the demand for firewood within a few years likely to be such as would warrant some conservancy? I do not think there is any doubt that within the last few years a great deal of land has under the present system been more or less *cleared* but it by no means follows that the ploughman treads on the heels of the "lumberer." I am sorry I cannot give figures applying to the whole forest in this regard but the following may suffice. In the Nujeeabad forest proper, i. e. roughly speaking from the Khop and the head-waters of the Gānghun to the Peelee Rao and the Ganges, containing about 100,000 acres, there were at the time of the mutiny 4,990 acres cultivated, this year the amount of cultivation is 5,461 acres,, and this is five years' progress in this direction. But still further, what increase of cultivation may have recently taken place within the forest bounds has in almost no case been effected within the forest proper, when on the contrary within but a few years many villages have become waste. The fact appears to be that any considerable increase of cultivation within the forest bounds takes place in ordinary circumstances along its edges, and as has been before indicated, reasons connected with the physical structure of the tract and the scarcity of water render it almost impossible that it should be otherwise, and for similar reasons the cultivation from the inner edge must always be very limited, here much more so than opposite Kumaon where streams of some size are much more frequent.

With these views I cannot but consider any estimate, such as that given regarding the Chandee and Nujeeabad Forests, of 75 p. c. of cultivable land, as extremely fallacious, though doubtless something like that proportion may be *arable* in the literal sense of the term.

The very Boksas whom it has been the habit to suppose "to the manner born" seem only to have been originally driven to settle *within* the forest belt by external pressure, and now that pressure has been for many years removed even they tend to leave the intra-forest clearings. Several of these last have within the memory of man been deserted, and almost the only village which has increased in size by immigrations is Bergnalla, which is de facto in the Tarāi belt outside the forest proper. For many years at least and until every acre of available land outside of the dry forest has been brought under the plough, it seems very unlikely that men will voluntarily betake themselves to agriculture on the large scale in this tract where so many difficulties have to be faced.

Any large increase of the demand for fire-wood to be supplied from the Bijnour forest depends on the advance of Railways, and in particular on the not improbable contingency of a lateral, longitudinal Railway line with transverse branches, permeating Rohilkhund within a few years. As illustration of what will take place in such a case, I may mention that I have it on reliable authority that between Allahabad and Cawnpore, at the time of the commencement of Railway operations, the price of fire-wood was about 9/ a hundred maunds *i. e.* a very little over what the price of the same commodity now is at Nujeebabad a few miles outside our forest-belt. Now (1863), the contract price of Railway fuel between Allahabad and Cawnpore is 19/ a hundred maunds, *i. e.* the Railway has rather more than doubled the rate. From a sufficiently near approach of the Railway, a similar result may be expected here, if means are not taken to modify the effects of the increased demand.

More knowledge of details than I at present possess, and very probably a year or two's experience of the effects of such approach, would be necessary in order to determine the best possible steps by which to meet the increased demand for fire-wood. It appears to me however that in order not only to

meet this demand effectually but to lessen the Railway expenditure as well as that of the people generally under this head, one feasible method would be to divide off the forest into manageable segments, in only a certain proportion of which alternately would any wood-cutting or any jungle-fires be permitted each year. By some such plan the evils of indiscriminate cutting and turning, under the impending contingency, might be guarded against.

Under the present system of working, the main part of the funds is expended on roads, of which 225 miles are in the Collector's Report, stated to be maintained in and near the forest. Within the limits of the forest there is not much thorough traffic, the only roads crossing it on which any great amount of such traffic exists being that from Kaloo Shuheed (at the mouth of the pass into the Patlee Doon) to Burrapoora, that from Koldwāra to Nujeebahad,—and that from (the western) Laldhang to Amsote. On these roads besides the ordinary timber traffic a very considerable amount of merchandize comes from Gurhwāl by Koldwāra for several months of the cold weather when a depot of bunyas is in full play there. I have in 2½ hours on a November morning, counted 200 men and boys with head-burdens of grain, red pepper &c. &c., come into Koldwāra. A good deal of *pahari* traffic is also done on the Laldhung and Amsote road.

Besides these three roads, the others within the forest are merely for timber-carriage, and do not require much to keep them in fair working order. The extension of the Sub-Siwālik road from (Kaleedōongee by) the eastern Laldhang towards Hurdwār, which it is expected will be completed this year by an additional 19 miles in this district, is hardly an exception to this, for the amount of thorough traffic on it seems, at present at least to be very small. A much more important road, and one the state of which may bear very materially on the forest revenues, is the main longitudinal line, running parallel to, and at last on the outer edge of the for-

est from Nujeena to Nujeeabad, Amoste, and Kunkhul, on parts of which the amount of general and timber traffic is very large. It may be found that hitherto, the comparative amount expended on the internal forest roads has been smaller than it might have been, as the prospect of immediate or even direct return from them is not at once apparent, but perhaps in future more may be done in this direction.

The views as to future management deducible from the above remarks may be easily and briefly summarized.

1. Without indulging in the fertile hope of ever seeing any very large proportion of the forest cultivated which, were it possible, does not seem very desirable so long as there is untilled land elsewhere in the Zillah, it is nevertheless an object to foster cultivation from either edge. That on the inner border and on the canals supplied from it, appears already to have rendered its profitable maximum or nearly so, and that outside will practically be limited by the extent of capabilities for irrigation, at least until an absolute dearth of land for cultivation in healthier spots causes part of the non-productive dry forest to be reclaimed. From all I can learn, just as in the Kumaon Bhābur, from the fact of the typical Tarāi being more fully developed there, and tolerably large streams being more abundant along its inner border, the evils of the Sub-Siwalik tract were greater than here, so these very circumstances render its reclamation and consequent situation much more extensively feasible than to the west of the Ramgunga.

2. The adoption of some system of conservation for even the smaller tracts and steep slopes of *sāk*.

3. The careful selection, when possible, of respectable men with some capital as lessees, as they will probably be more amenable to rule and much less likely by indiscriminate cutting to exhaust the capabilities of the forest, especially in regard to Bamboo, wherever that is found.

4. A larger expenditure on the internal forest-roads, in

particular the longitudinal Sub-Siwālik one, and the main transverse lines.

5. And last, as the Railway lines approach, the adoption of some manageable system by which $\frac{1}{2}$ or $\frac{1}{3}$ only should be each year liable to wood-cutting and above all burning.

I fear that this paper with so many details that are often perhaps more curious, than useful may give rise to the exclamation "Oh monstrous! but one half penny worth of bread to this intolerable deal of sack!" but in collecting the information necessary for it, I gradually came to the conclusion that the best way to treat it was to do so as fully as possible. And this for two reasons 1st. no previous attempt has, so far as I know, been made to deal with the whole Sub-Siwālik tract, and 2nd, some of the topics treated of which may seem at first sight to have no very useful bearing, are in reality of some practical importance *e. g.* the physical structure of the forest belt in its relation to the improbability of the whole ever being cultivated.

In conclusion I may state the chief printed sources on which I have drawn for information connected with the various branches of the subject, to guide or supplement what I have personally gleaned.

In regard to the geography, structure, cultivation &c., of other parts of the Sub-Siwālik belt near or remote, I have been indebted to Traill's Report on Kumaon, Mr. Batten's Report on the Kumaon Bhābur, Jones' Report on Rohilkhand canals, Elliott's supplement to the Glossary N. W. P., Strachey on the physical structure of the Himalaya, Jameson's Report on the physical aspect of the Punjab, and Hooker's Himalayan Journals.

Respecting especially the indigenous vegetation of various parts of the tract I have been aided by Hamilton Buchanan (in Martin's Eastern India) Royle's Illustrations of Himalayan Botany. Griffith's Itinerary notes, Hoffmeister's travels in India, and Dr Thomson's Western Himalaya.

And I have drawn largely on the following for information as to the production and qualities of timbers and vegetable products generally in neighbouring or distant parts of India. Madden on the Tarāi of Kumaon (Journ. Asiat : Soc : Calcutta 1848), Col: Ramsay's Report on the Kumaon Forests for 1861, Capt. Pearson's Report on the Forests of Central India (1861), Col: Cunningham on the stone and timber of the Gwalior territory, Munro on the Timber Trees of Bengal (J. A. S. 1847), Long's Indigenous Plants of Bengal, (J. Agri. and Horticultural Society of India, vols. ix and x.) Drury's useful Plants of India, Dalzell and Gibson's Bombay Flora, and Birdwood's catalogue of Bombay vegetable products. To Col: Munro's paper in particular I owe the few figures I have given as to the strength and specific gravity of various kinds of timber, as opportunity and resources did not avail me to institute fresh experiments on the timbers of local growth.

Personally however I have had various advantages in investigating the geography and productions of the Bijour Forest. Besides spending many weeks last cold weather (between Novr. 20th 1862, and May 20th 1863) in the forest for the pursuit of such investigation, I had the privilege of perusing Mr. Palmer's Forest Reports and examining the maps in his office, of making frequent enquiry on various points of Mr Firm in charge of the Gurhwāl (and Chandee) Forests, and of constant reference to the native official who of all in the district is, I conceive, best qualified to get and give information on such matters,—Anoop Sing, Tahseeldār of Nujeeabad. To each and all of these I have to confess my obligations, and I shall close with the expression of a hope that the multiform information thus acquired and here systematized may not prove altogether useless to future inquirers in similar fields.

JOHN LINDSAY STEWART, M. D.

September, 1863.

Civil Surgeon Bijour.

Monthly Proceedings of the Socie y.

(Thursday, the 21st January 1864.)

A. Grote, Esq., President, in the chair.

The proceedings of the last monthly meeting having been read and confirmed, the members proceeded, in accordance with the Bye-Laws, to the election of Officers and Council for the current year, and the President having appointed Drs. Tonnerre and Bonavia to be Scrutineers, they reported the result to be as follows :—

President.—Mr. A. Grote.

Vice-Presidents.—Mr. W. Haworth, Baboo Ramgopal Ghose, Dr. Thomas Anderson, and Baboo Pearychand Mittra.

Secretary.—Mr. A. H. Blechynden.

Council.—Dr. J. B. Barry, Rajah Pertaup Chunder Sing Bahadoor, Mr. W. G. Rose, Mr. Joseph Agabeg, Mr. T. H. Mossley, Mr. S. P. Griffiths, Capt. W. N. Lees, Mr. C. E. Creswell, Mr. C. B. Stewart, Mr. S. Douglas, Baboo Gobind Chunder Sen, and Mr. W. Stalkartt.

STANDING COMMITTEES.

The revision of the Standing Committees, was next entered on, and the names of the following members were added where vacancies had occurred, viz. :—

Implements of Husbandry and Machinery—Capt. F. S. Stanton ; *Oil and Oil Seeds*—Mr. F. Schiller ; *Nursery Garden Committee*—Dr. Anderson ; *Fruit and Kitchen Garden Committee*—Mr. C. E. Creswell and Mr. John Stalkartt ; *Floricultural Committee*—Dr. Anderson and Mr. R. Scott ; *House Committee*—Mr. Joseph Agabeg ; *Tea Committee*—Dr. J. B. Barry.

The ordinary business was then proceeded with, and the following gentlemen, proposed at the last meeting, were duly elected members :—the Secretary of the Soom Tea Company, Darjeeling, Major E. Thompson, the Moharajah Bhowany Sing, Capt. O. M. Drew, Messrs. James Hennessey and John Sturmer, C. E.

The names of the following gentlemen were submitted as candidates for election :—

Capt. C. S. Lane, Dy. A. C. General, Dacca,—proposed by the Secretary, seconded by Dr. Tonnerre.

Lieut. W. Knyvett, District Superintendent of Police, Dacca,—proposed by the Secretary, seconded by Dr. Tonnerre.

H. Ridsdale, Esq., Calcutta,—proposed by Mr. W. Haworth, seconded by the Secretary.

T. W. Bayes, Esq., Calcutta,—proposed by Mr. W. Haworth, seconded by the Secretary.

Baboo Luchmeesput Doogar, Banker, Calcutta,—proposed by Baboo Huree mohun Sen, seconded by Baboo Peary Chand Mittra.

John Reid, Esq., Inspector General of Police, 1st Grade, Moulmein,—proposed by Col. A. Fytche, seconded by the Secretary.

Charles Ady, Esq., Merchant, Moulmein,—proposed by Col. Fytche, seconded by the Secretary.

Commanding Officer, 19th Hussars, Meerut,—proposed by the Secretary, seconded by Mr. W. G. Rose.

A. A. Tripe, Esq., Amoah Factory, Tirhoot,—proposed by Mr. J. M. Becher, seconded by the Secretary.

C. M. Voss, Esq., Merchant, Bimlipatam,—proposed by Mr. Joseph Agabeg, seconded by the Secretary.

W. S. Atkinson, Esq., Director of Public Instruction,—proposed by Mr. Grote, seconded by Mr. Rose.

The following contributions were announced :—

1.—Selections from the Records of Government of Bengal No. XL.—By the Government.

2.—Statistics of the Trade of the Port of Calcutta—by W. H. Wood, Esq., Secretary of the Chamber of Commerce. Presented by the Author.

3.—Memoirs of the Geological Survey of India. Presented by Dr. Oldham.

4.—The Second Annual Report of the Acclimatisation Society of Victoria.—Presented by the Society.

5.—The Annals of Indian Administration, Part 4 of vol. 7. Presented by the Government of Bengal.

6.—Journal of the Asiatic Society of Bengal, No. 4 of 1863. Presented by the Society.

7.—A parcel of Tobacco raised in the Myunomug District from seed received through the Society from Rungpore. Presented by the Chief Commissioner of British Burmah. (Referred to Committee for Report.)

8.—Samples of Cigars made from Tobacco raised at Allahabad from acclimated Havanna seed received from the Society. Presented by Mr. R. J. Carberry.

A portion of these Cigars is of pure acclimated Havanna, and a portion of

the same, but covered with Sandoway leaf, as the leaves of the Havanna were small and not well-adapted for covering.

9.—Small samples of Coffee grown at Myodwin from seed supposed to have been obtained from Ceylon. Presented by Mr. H. Leeds, Officiating Conservator of Forests, British Burmah. (Referred to Committee for Report.)

10.—Moths, male and female, of the Eria and Mulberry, with their cocoons, from Munneepore. Presented by Dr. Thomas Dillon.

11.—A packet of flower seeds from Geneva for the Society's garden. Presented by Mr. J. F. Galiffe.

Provision of Seeds for 1864.

A report from the Committee of the Council in respect to the supply of seeds for the current year was first read.

“In accordance with the Resolutions passed at a recent meeting of the Council, your Committee have duly taken into consideration the subject submitted to them, and now beg to report as follows :—

FIRST.—*In respect to seeds of field crops.*—The Society have been importing these seeds from England for the last seven years to the extent of £ 150 annually. It would appear from the records that the general purport of the reports received from the parties to whom these seeds have been distributed, have, with few exceptions, been unsatisfactory. Under these circumstances, your Committee do not think it advisable to continue importations from England. They would rather recommend that smaller orders, say to the extent of £ 40 each, exclusive of freight and other contingent charges, be sent to Melbourne and the Cape of Good Hope for certain kinds, omitting the annual fodder grasses and the perennial species, and some other sorts of field crops which have been hitherto included in the consignments. A list thus revised is annexed. Your Committee suggest that the seeds from the Cape be shipped in all July, and those from Melbourne by Steamer in August.

SECOND.—*In regard to English vegetable seeds.*—There can be no doubt from the statement of the Secretary, who had these seeds tested before despatch, and from the favorable report of the Gardener who sowed them immediately on their arrival in May, that no blame can attach to either of the seedsmen employed. (Messrs. James Carter & Co., and Jacob Wrench and Sons). The consignments were despatched overland by the second Steamer in March, with the view of allowing of their distribution to Members in Upper India and the Punjab before the commencement of the rainy season, thereby avoiding the injury which it is probable all seeds, more or less, sustain from a long journey in July and August. This object was only partially attained : and, in consequence, it is evident from the many reports of failure which have been received, that though the seeds were in

good germinating condition on arrival, they suffered so considerably from damp in June, July and August as to be rendered unserviceable. With the view of avoiding this in future, your Committee recommend that instructions be given to Messrs. James Carter and Co.,—to whom they would entrust the necessary supply for this next season,—to despatch it by the second steamer in July, and that no time be lost, immediately after receipt, in distributing their shares to the more distant subscribers early in September. Now that facilities of communication are so much greater than formerly, it is hoped the seeds may arrive in good time for sowing even to Members in the Punjab.

THIRD.—*English Flower seeds.*—Your Committee have somewhat modified the list of flower seeds, and these they recommend should be forwarded with the vegetable seeds. Both lists are annexed.

FOURTH.—*Vegetable seeds from North America.*—These having given general satisfaction, a similar order to the last was sent to Messrs. D. Landreth and Son in November, 1863.

Lastly, your Committee suggest that this their report be not only published in the next monthly proceedings of the Society, but that copies be forwarded to Members in Upper India, and that they be requested to notify, in due course, the result of their sowings, with the view of enabling the Council to ascertain whether the period of despatch, now recommended, has been found suitable to the majority, or whether it would be more desirable to have two despatches in 1865, viz., one for distant Members, to reach Calcutta at the commencement of August, and another for Residents in Bengal and Behar to arrive in the beginning of September.

A. GROTE,
ST. DOUGLAS,
W. STALKARTT,
PEARY CHAND MITTRA,
S. P. GRIFFITHS,
THOS. ANDERSON, M. D.

METCALFE HALL,

Calcutta, 7th January, 1864.

Resolved.—That the Report of the Committee be confirmed.

Proposal for a Public Garden.

The Council next submitted, for the approval of the Meeting, the following Resolutions of a Special Committee of their body to whom they had referred, for enquiry and consideration, the subject of a public garden on the Calcutta side of the river.

After referring to a communication which they had received from Dr. James Anderson, with estimate of the value of the Kidderpore Orphan Asylum property, and from the Superintendent of the Barrackpore Park, with an account of the monthly expense incurred in keeping up that Establishment, the Committee agreed to the following Resolutions :—

“*First.*—That the Committee are of opinion that the present financial position of the Agricultural and Horticultural Society does not admit of its purchasing ground on the Calcutta side of the river, on any site which would be at all eligible for their Nursery Garden.

“*Second.*—That the Committee after enquiry for a site which would be centrally situated, and at the same time suitable for their purpose, have not succeeded in finding one that would be in every respect desirable, but in the event of funds becoming available, they beg to indicate the property of the Kidderpore Orphan Asylum as the only available site which would at all suit their requirements.

“*Third.*—That it be therefore recommended to the Council to address the Government soliciting them to present to the public, for the purposes of a public garden, such portion of the Kidderpore property as would be suitable for that purpose, and proposing that, in the event of the same being granted, the Agricultural and Horticultural Society would remove their Nursery Garden to a portion of the ground and undertake the management of the entire establishment, provided that the expense to be incurred by the Society in such management do not exceed that now incurred in the maintenance of their Nursery Garden.”

Moved by the President, seconded by Colonel Fyche, and carried unanimously, that this meeting cordially adopt the Report of the Council, recommending that Government be addressed on the subject of a public garden.

Cattle Murrain in the Madras Presidency.

Read a communication from the Under Secretary, Government of Bengal, submitting a letter from the Secretary to the Government of Fort St. George, with its enclosure, relative to the Cattle Murrain which is at present raging in some parts of the Madras Presidency, and requesting any information that the Society may be able to obtain on the subject.

The Council report, that having circulated these papers among the Members of their own body and to others who had given the subject attention, they now beg to submit some valuable remarks from Dr. Barry, Mr. Caleb Ladd, Mr. A. Sawers, and others, which they suggest should be embodied in a letter in reply to the above enquiry; further, that certain papers bearing

on the same subject which have been published in the Society's Journal, be, at the same time, brought to the notice of Government.

Resolved, that the suggestions of the Council be adopted.

Ornamental Plants and Bulbs for the Society's Garden.

Read Reports from the Gardener on an assortment of bulbs from Messrs. Vietch and Son and on a collection of ornamental plants received from Messrs. James Carter and Co., *via* the Cape, in Wardian cases. The bulbs consist of Caladiums, Begonias, Achimenes, Gesneras, Gloxinias, Tydeas and a few other kinds, rather more than one-half of which are doing well. Among other kinds of plants are Dipladenias, Daphnes, Kalosanthes, Lapagerias, Passifloras, Bouvardias, Caladiums, Mandevillea, Begonias, &c. More than one-half of the total number have reached alive.

Dyes from Upper Assam.

Read the following report from Mr. David Waldie on the samples of coloring matter from Mr. W. H. Brownlow, which were submitted at the last general meeting :—

"I have examined the sample of colouring material you sent me lately, along with the letters from Mr. Brownlow. It is evidently a vegetable extract containing an astringent principle and a colouring matter. Like astringent vegetable substances in general, it gives a black precipitate with salts of iron: the colouring matter is precipitated best by salts of tin, and can be imparted by that means to cotton or silk, which thereby acquire a purple colour. The colour does not immediately yield to the action of soap, but by the aid of heat and a little time it does almost completely. The colour is not particularly fine, and the amount of coloring matter appears small. Many vegetable substances contain colouring matter, but it is only when this exists of superior quality and in considerable quantity that they can be advantageously employed as dyeing materials, and I do not think that this substance fulfils these conditions to a sufficient degree to make it at all promising."

Tobacco from the Punjab.

Read also a report from Mr. Joseph Agabeg on the sample of Tobacco manufactured in the Punjab, and submitted by Captain Lees at the November meeting.

"The sample of Tobacco you have sent me as being cultivated and cured in the Punjab, is satisfactory enough as being the first sample in imitation of American, which is sold here at 6 annas to 1 rupee a lb. according to its quality.

In its present state it is difficult to give an opinion as to its value, since it is not in a marketable or merchantable state: But I have no doubt by a

little trouble, care, and attention, the condition and quality might be very much improved."

Communications on various subjects.

The following letters were likewise read :—

1.—From Mr. F. D. Seaché, Rampore Bauleah, dated 21st December, respecting the manufacture of a wine from the Jamoon fruit.

"With the very common jungly fruit which the natives call Jâm or Jâmoon, the undersigned made, during the last June in Rampore Bauleah, a wine, that for its qualities and taste was almost similar to the wine made from grape.

"This wine is also very cheap, as from two maunds of the fruit collected in the jungle at that time, about one maund of wine was made, which cost altogether three Rupees.

"The undersigned thought of renewing the experiment next June, but on account of his health, he is now obliged to leave for home immediately; and not to let his discovery be hereafter neglected, the undersigned begs to acquaint the A. & H. Society of this fact, and further to express his willingness to supply the Society with any other information which may be required for the fabrication of the same wine, which, however, presents no difficulty, as it is made by the same process by which wine from grapes is obtained."

2. From Capt. S. Ryder, applying for information respecting the preparation of Aloe and Pine apple fibre, as both plants flourish at Jubbulpore. (Information supplied.)

3. From Dr. Asa Gray, Corresponding Secretary, American Academy of Arts and Sciences, Boston, advising despatch of certain volumes of their memoirs and proceedings.

4. From Dr. J. L. Stewart, promising to contribute certain papers for the Journal.

5. From Capt. S. Chalmers, Secy. Public Gardens, Dinapore, returning thanks for the seeds supplied for their garden.

6. From Messrs. James Carter & Co., advising despatch of Rose cuttings. (These have recently arrived.)

For all the above contributions and communications, the best thanks of the Society were accorded.

(Wednesday, the 24th of February 1864.)

A. Grote, Esq., President, in the chair.

The proceedings of the last monthly meeting were read and confirmed.

The following gentlemen were elected Members :—

Captain C. S. Lane, Lieutenant W. Knyvett, Baboo Luchmееput Doogar, Commanding Officer 19th Hussars, Messrs. H. Ridsdale, T. W. Bayes, John Reid, Charles Ady, A. A. Tripe, C. M. Voss, and W. S. Atkinson.

The names of the following gentlemen were submitted as candidates for election :—

Charles Minchin, Esq., of Bimlipatam,—proposed by Major W. Owen, seconded by the Secretary.

H. B. Webster, Esq., S. C., Boolundshuhur,—proposed by Mr. F. Beaufort, seconded by Mr. Grote.

Baboo Mooralaydhur Sein, Solicitor,—proposed by Baboo Peary Chand Mittra, seconded by Baboo Shib Chunder Deb.

Major C. Herbert, Allipore,—proposed by Mr. Grote, seconded by Mr. W. G. Rose.

Wynn Jones, Esq., C. E., E. I. Railway,—proposed by Mr. Edwin Sturmer, seconded by Mr. John Sturmer.

Captain E. Fowle, Rangoon,—proposed by Mr. Grote, seconded by the Secretary.

W. Ter Veen, Esq., Merchant, Calcutta,—proposed by Mr. Haworth, seconded by Mr. Rose.

J. W. S. MacArthur, Esq., Superintendent, Opium Factory, Ghazeeepore,—proposed by Mr. Rose, seconded by the Secretary.

The following presentations were announced :—

1.—Report of the Administration of the Madras Presidency for 1862-63, Annual Reports on the Administration of the Central Provinces and of the Province of Oude for 1862-63. By the Government of Bengal.

2.—Report of the Committee of the Bengal Chamber of Commerce, from May to October 1863. By the Chamber.

3.—Specimens of Burmese Agricultural Produce and models from the Agricultural Exhibition. Presented by Captain E. Fowle, Secretary, Local Committee, Rangoon.

4.—Specimens of Agricultural produce from Benares. Presented by Mr. W. Halsey, Secretary, Benares Local Committee.

The Secretary announced, in addition to the above, the receipt of a large collection of other models of agricultural machinery which were submitted at the Agricultural Exhibition.

5.—A large Tea plant from Assam Stock. Presented by Mr. W. Eames.

6.—A quantity of cuttings of good kinds of roses recently imported from England. Presented by Mr. S. P. Griffiths.

7.—A plant of *Ferraria undulata*. Presented by Mr. Grote.

Mr. Geo. Bartlett exhibited two *Pelargoniums* of a rare kind, in flower, and two *Picotees* in full flower, all from English Stock, acclimatized at Simla.

Annual Report.

The Secretary read the Annual Report, on which it was moved by Major C. L. Showers, and resolved that the Report of the Council be received and adopted.

HORTICULTURAL EXHIBITION.

The following reports of the Judges on the Show of vegetables, fruits and flowers, held at Allipore on the 23rd of January, were next submitted :—

Horticultural.—Notwithstanding the heavy fall of rain in the early part of November, which did considerable damage to early crops, the vegetable department at this show did not contrast unfavorably with previous exhibitions. Though not equal, perhaps, to some of its predecessors, it was not inferior to the majority.

In the collection of peas of six or seven kinds, several good baskets of imperial blue, prussian blue and marrowfats were placed on the stands, and some of *Knights* and *Victoria*; but on the whole, they were not so well represented as at the first exhibition of 1863. The *Brassica* tribe included cabbages of very good quality, both large and small kinds, sugar loaf, savoy, early york, drumhead, &c. The red variety was rather scarce. Cauliflowers were fairly represented in quantity and quality. Of Brussels sprouts, there were several very fine specimens in pots, one with sprouts on. This remark is also applicable to curled greens; likewise of brocoli, there were some remarkably good specimens. Knole Kule shewed well, and so did onions; leeks were of moderate size. Beet, both long and turnip rooted, fine dark specimens, were excellent. Beans were altogether poor of the several sorts exhibited. Of lettuce, there were several good baskets, especially of the *cos* variety. Turnips of white and yellow kinds, and carrots, both early horn and Altringham red, were well represented; a medal was given for the best turnips. Of calery, there were a few fair samples, and for the best a medal was awarded, but most of it was stringy. Potatoes were much better shown than last year, as there were many fine baskets of white and brown skinned varieties, the latter remarkably heavy; a medal was given for the best sample. A few good baskets of globe artichokes were produced, but they were small. Asparagus very inferior being too early in the season.

In addition to the produce of Calcutta gardens, there were shown on this occasion some fine specimens from the gardens of Mr. Thos. Savi of Kishnaghur and Dr. H. F. Hutchinson of Arrah. For these, special prizes were awarded. In Mr. Savi's collection were some exceedingly fine squashes, about the best that have ever been exhibited.

There was a pretty large collection of native vegetables including brinjals, of an unusually large size, and some very fine capsicum.

The fruit department did not display much variety, but there were some exceedingly fine baskets of Bael, the owner being attracted by the handsome special prize of Rs. 16, for the best basket of six specimens offered by Dr. Tonnerre. Banee Ghose of Bealah was the successful candidate for this prize.

About 100 Gardeners were present on this occasion, and prizes amounting to Rs. 319 were awarded to 48 as per list annexed.

(Signed) ST. DOUGLAS,
PEABYCHAND MITTRA,
C. E. CRESSWELL,
W. G. ROSE.

Floricultural.—A large collection of plants was submitted on this occasion.

Roses occupied the most prominent position. The produce of ten gardens was placed on the tables. The collection from Rajah Pertaup Chunder Sing's garden was the largest, including 25 kinds: that from the Tank Square garden was the next, including 15 kinds. Mr. J. S. Elliot and Colonel Herbert's collections, though less numerous, contained several well-grown plants. Rupees 35 were awarded for this class, including a fine specimen from the Honorable Mr. Steer's garden.

The plants of *Olea fragrans* were, perhaps, finer than at any previous Exhibition: besides the fixed prizes, a special prize of 8 Rs. was given by Baboo Kissory Chund Mittra for the best specimen, which came from the garden of Baboo Suttayanund Ghosal.

Camellias showed pretty well, especially those from the garden of Babo Bindabunchunder Mittra.

The collection of Pelargoniums included several exceedingly well-grown individuals from Mr. Henry Wood's garden.

The Bulbous tribe was not well represented; but there were some fine Begonias from Capt. Tronson's garden; also a fine collection of Ferns from the same locality, and Oxalis from Mr. Grote's garden.

The show of Verbenas, Portulacas, Pinks, Violets and Campanulas was not beyond the average. There was a fair collection of *Tropeolums* and several interesting specimens of Cacti.

Among the rarer plants was a fine individual of *Dammara Australis*, a *Paspiflora gracilis*, a *Beleperone (oblongata?)*; and a few pots of *Eucharis Amazonica*.

The produce of 32 gardens was brought forward, and prizes, amounting to Rs. 230, were awarded to 27 mullees.

Though not better than some of its predecessors, this exhibition may be regarded as a fair average one. The rain-fall in November accounts for the general backwardness of imported annuals.

(Signed) A. GROTE,
S. P. GRIFFITHS,
R. SCOTT,
T. ANDERSON,
W. STALKARTT.

In connection with the above, a note was read from Rajah Kalikrishna Bahadoor respecting a fine Orange from his garden which was submitted at the Exhibition. The Rajah states that the plant from which this orange was taken was purchased about 16 years ago from a *Malce*, who represented it to be of the Sylhet kind. It produces freely in the proper season, and in small quantities the rest of the year. It is about 24 feet high and healthy in appearance.

The Secretary stated that the fruit in question had more the appearance and taste of the Orange of Upper India than of Sylhet. The Rajah had promised grafts for the Society's Garden in due season.

The Council propose that the next show be held in April, the precise date to be fixed at the next monthly meeting; and this was agreed to.

TOBACCO AND COFFEE FROM BRITISH BURMAH.

A report from the Committee (Mr. Joseph Agabeg, Dr. Tonnere, and Baboo P. C. Mitra) was read on the samples of Tobacco and Coffee raised in British Burmah which were submitted at the last meeting by Colonel Playre and Mr. Leeds.

Resolved, that copies be forwarded to these gentlemen for their information.

Cattle Murrain.

Read the following letters on the above subject:—

TO THE SECRETARY TO THE AGRICULTURAL AND HORTICULTURAL SOCIETY.

General.

Fort William, the 10th February, 1864.

SIR,

I AM directed to forward the accompanying copy of a letter, dated the 3rd instant, from Mr. John Salkartt, enclosing a Report from Veterinary Surgeon Mr. Rutherford, relative to the disease prevailing at present among the Cattle in Calcutta and its neighbourhood, and to request that the Society will be so good as to favor the Lieutenant-Governor with their early opinion as to the nature and extent of the disease, and as to the practicability of adopting measures to prevent it from spreading.

2. I am to add that if, for making enquiry into the subject, the Society should require the co-operation of the Local Officers, it will be readily afforded.

S. C. BAYLEY,

Junior Secretary to the Government of Bengal.

From John Stalkartt, Esq., to Colonel H. C. James, Private Secretary to His Honor the Lieutenant-Governor of Bengal,—(dated the 3rd February 1864.)

SIR,

WILL you kindly lay before His Honor the Lieutenant-Governor that the murrain which attacked the cattle at the Great Agricultural Exhibition is spreading, and some Commission should be appointed to devise means to check it early. Bengal has very few cattle, and should it pass into the villages it will be very serious. Mr. Apcar has lost three Arab cows. I have lost one Arab cow and four calves. My English bull is attacked and is not likely to live; also two other cows. I noticed that a young Bramminee bull on the road has also died of it.

Before the Exhibition Mr. Allardyce lost two English cows, and others in the neighbourhood whose names I do not know.

It is, in my opinion, a malignant murrain, and enclose a letter from Mr. Rutherford, the Veterinary Surgeon of Messrs. Hunter and Company, on the subject.

S. C. BAYLEY, Esq., *Junior Secretary to the Government of Bengal.*

SIR,

I have the honor to acknowledge the receipt of your letter No. 705 of the 10th Instant, enclosing copy of a letter from Mr. John Stalkartt and report from Mr. Veterinary Surgeon Rutherford respecting the disease at present prevalent among the Cattle in Calcutta and its vicinity, and requesting the Society's opinion "as to the nature and extent of the disease, and as to the practicability, of adopting measures to prevent it from spreading."

2. In reply, I am directed by the Council to mention that the Society has already reported to Government in my letter of the 1st February 1864, the result of enquiries made in consequence of the reference from the Madras Government.

3. The Council are of opinion that the subject of Mr. Stalkartt's letter is one which should be fully enquired into and that it can best be conducted by some Officer of Government appointed specially for that purpose. The Gentlemen whose names are mentioned in the margin, will, I am directed to add, gladly co-operate with the Officer so appointed. The Council believe that a Medical Officer, if available, would probably be best able to conduct such enquiry.

Mr. A. Grote
Mr. C. E. Creswell
Dr J. B. Barry
J. Agabeg
Mr. S. Apcar
Mr. J. Stalkartt
Mr. C. Ladd

4. The Council are further of opinion that the measures which should be adopted to prevent disease from spreading can be more efficiently considered after the report has been made by the Officer so appointed.

I have, &c.,

(Signed) A. H. BLECHYNDEN.

19th February 1864.

Secretary, A. & H. S.

COTTON CULTURE IN THE PUNJAB.

Read a letter dated Lahore, 16th January, from the Personal Assistant to the Financial Commissioner of the Punjab, of which the following is an extract :—

“ There is an immense demand throughout the Punjab for cotton seed acclimatized. Could you kindly secure me any, and if so, in what quantities? I am prepared at once to take at least 100 maunds if you could secure and despatch it to me. It is however essential that it reach me in the early part of February. I would prefer New Orleans, but should this not be available, I am prepared to accept Egyptian cotton seed to the same extent: or again should there be no acclimatized seed would you procure and send me some few maunds of seed directly imported as I doubt if it will germinate freely.”

The Secretary stated he had lost no time in applying to Messrs. Thomson and Mylne of the Jugdispore Estate, in Beheea, Shahabad, to Mr. Bingham of Chynepore, Susseeram, and Mr. J. Gilmore of Rehul, for acclimatized seed. Messrs. Thomson & Mylne had most readily responded by forwarding gratuitously a quantity of acclimatized American and Egyptian seed, and Mr. Bingham had also promised to send gratuitously all he could spare. Mr. Gilmore was unable to assist owing to the cause explained in a letter dated 2nd February, of which the following are extracts :—

“ I have just received your letter of 25th ultimo, and in reply beg to assure you of my inability to meet the application in question at present. Nor could I promise to comply hereafter.

Mr. Bingham visited the plantations in November last, or soon after the rains were over and when the plants of some of the fields looked very promising, healthy, and blooming with flowers; but before the pods had half formed themselves, frost and cold wind set in so that out of 100 acres there remains but some 30 acres (sown in July) that may yet yield, for though the pods fell off, the plants were not materially affected by the frost, and are now putting forth new leaves and flowers. The field has been hoed and cleaned and should the mist and clouds now gathering around prove to be rain and not frost, an im-

monse deal of good will result therefrom and a paying crop, &c. may then be looked for.

Two other fields of Cotton plants (sown in August) of like area, which were above two feet high, have so far shrivelled up that only the lower portion of the stem and roots are living, and of the remainder (sown in September) which had only attained a foot or so high have been completely burned as it were away.

Could August's fields be irrigated, a crop would be obtainable this year, but I had no time before the rains set in, nor did I care to make arrangements after it. For I find now all that the Cotton plant requires here to make it a profitable cultivation, for which purpose alone I undertook it, is to have the land well-prepared and seeds sown early in the season, May and June, not later than 15th July, and hoed twice during the growth of the plants. This will allow the plants to mature and the pods to form before the effects of the rains are over and to ripen and develop the cotton ere frost sets in. Most of the Hill men rear a small patch of cotton for home-use, sow in June and pick during December; these have gathered in their crops and are now employed in preparing it for weaving.

Some of the plants of July's sowings, but sown early in the month, are four feet high and many have run up much higher, but spindly; these developed a few pods before frost time and are even now yielding a small quantity of stained or ill-formed cotton, not sufficient to keep a woman at work at the Native Churka for a couple of hours daily. To forward a sample of it would neither be doing justice to the gentleman who furnished me with seeds nor the capability of these hills, as a cotton-producing district.

I am happy to say no maggots appear in the pods up here, though a few leaves were attacked during the rains, but which I had fished out at once. At Deheree Ghat (Soane River) I planted about $\frac{2}{3}$ of an acre, in June, on well-prepared and manured ground. The plants grew up very luxuriantly, are of considerable size, and loaded with pods, but strange, hardly a pod opens without the cotton in it being stained and seeds eaten away by a little blue maggot. Most of the pods, having the seeds eaten, have not sufficient power left in it to burst or develop itself. Leaves not touched. Should my July's planting come to any thing, I shall let you know the result. Many of the natives about here are anxious to try the cultivation of exotic cotton. I have promised them seeds to sow $\frac{1}{2}$ or 1 Bigah each person; they think that will be sufficient, for these people never sow cotton seeds, without burning a layer of jungle wood on site, which has been two or three times ploughed during previous rains, then taking advantage of every fall of rain before the season sets in to give as many ploughings as possible."

Read a letter from Captain Thomas Hutton, of Mussooree, offering some remarks on the silk moth alluded to in Dr. Maingay's paper published in vol. XIII. part 1 of the Journal. (Transferred for publication in the Journal.)

Read a letter from Mr. H. Reinhold, presenting a translation from the Dutch of the concluding portion of Dr. Jacobson's Handbook on the culture and manufacture of tea in Jáva, the first part of which was translated by the late Mr. Robert Frith and is published in the earlier volumes of the Journal.

The cordial thanks of the Society were offered to Mr. Reinhold for his translation which was referred to the Tea Committee.

Read an application from Dr. Alexander Hunter, Secretary A. and H. Society of Madras, for a quantity of the Bael fruit :—

“ I am desired by the Committee of the Madras Agri-Horticultural Society to request that you will be kind enough to order some good fresh Bael fruit (*Aegle Marmelos*) to be forwarded to Madras by the next Steamer.

Numerous applications have been received for seeds of this plant and it is the desire of the Madras Government that steps should be immediately taken to propagate the best quality of the fruit as it has been found to be a very efficacious remedy in Dysentery. There seem to be three species of Bael in this Presidency, only one of which is possessed of medicinal properties and the attempts which have been made at Bangalore to improve the jungle fruit by cultivation have failed. I should be much obliged if you could give us any information on this subject and if you could order 40 or 50 of the ripe fruit to be sent to my address by the earliest opportunity, the Society will gladly defray the expenses that may be incurred.”

The Secretary mentioned that this request had been fully complied with.

For the above communications and presentations, the best thanks of the Society were accorded.

(Wednesday, the 23rd of March 1864.)

A. Grote, Esq., President, in the chair.

The proceedings of the last monthly meeting were read and confirmed.

The following gentlemen were elected members :—

Messrs. Charles Minchin, H. B. Webster, C. S., Wynn Jones, C. E., W. Ter-Veen, J. W. S. Macarthur, Baboo Moorallydhur Sein, Major C. Herbert and Captain E. Fowle.

The names of the following gentlemen were submitted as candidates for election :—

E. G. Haddan, Esq., Calcutta;—proposed by Mr. E. Shearin, seconded by Dr. J. B. Barry.

S. J. Leslie, Esq., Solicitor, Calcutta;—proposed by Baboo Pearychand Mitter, seconded by the Secretary.

Major R. Richardson, 19th Hussars, Meerut;—proposed by the Secretary, seconded by Mr. Grote.

G. Edwin Lance, Esq., C. S., Cawnpore;—proposed by Mr. Charles E. Lance, seconded by the Secretary.

The following presentations were announced :—

1.—Selections from the Records of the Government of Bengal No. 39, Part 2. By the Government.

2.—Report of the Bombay Chamber of Commerce for the year 1862-63. By the Chamber.

3.—Proceedings of the Royal Horticultural Society of London Nos. 2 and 3 of Vol. IV. By the Society.

4.—A bundle of Sugarcanes of an unusually large size from Rangoon, for trial in the Society's garden. Presented by Captain E. Fowle.

5.—Four boxes of agricultural produce from Cochin, intended (but received too late) for the late Exhibition. Presented by A. M. Dowleams, Esq., Secretary of the Agricultural Exhibition.

6.—A plant of *Passiflora Goutieri* and of Scarlet Verbena. Presented by A. Grote, Esq.

7.—A further large quantity of cuttings of Rose plants of rarer kinds. Presented by S. P. Griffiths, Esq.

8.—Seeds of the celebrated Melon of Asia Minor, the *Kassi-bar*, of Pumpkin and Vegetable Marrow from the South of France, and of Mandarin Orange. Presented by James Cowell, Esq.

The Secretary mentioned that he had sent half of the melon seed to the Punjab Society.

9.—A minute specimen of fibre from the stalk, of downy filament from the follicle and of milky juice, of *Cryptolepis elegans*. Presented by Lieut. A. J. Wake, Royal Artillery.

The following is extract from Mr. Wake's letter :—

"I beg to enclose a branch of a plant, a pod taken off the plant and some fibres taken out of a pod which appears to be between a cotton and a silk, and to request to be informed of the name of the plant as also of the capability of the fibre being spun into thread either by itself or on being mixed with cotton.

I am informed by a native gardener that this pod becomes a white flower and blossoms between the months of June and July. I find the plant growing wild by itself as also twisting itself round and climbing large trees. On taking some of the bark off it, there appears to be a very strong fibre between the bark and the wood of the plant. Some of it taken out and twisted up made a very strong string. On collecting some of the milk from the plant and on drying it in coats on a sheet of paper in the sun, I made the piece of Indian Rubber enclosed. I would add that the plant is to be found in most of the gardens in the Station as well as growing wild. I would feel obliged for any information you can give me on the subject."

The Secretary mentioned that he had requested Mr. Wake to send a larger quantity of this fibre, with particulars in respect to mode of extraction, cost, &c., to admit of a report being made on it.

PATRON OF THE SOCIETY.

The President submitted a letter from the Private Secretary to the Governor General, in reply to his communication expressive of the wish of the Council that his Excellency would be pleased to accept the office of Patron of the Society. Dr. Hawthay states "The Governor-General has much pleasure in acceding to the request communicated in your letter of the 23rd February, that he would take Lord Elgin's place as Patron of the Agri-Horticultural Society of India."

The Secretary also submitted a certificate of prize awarded to the Society by Govt. for the best Hand Hoe or Cultivator exhibited by them at the late Agricultural Show at Alipore.

The Secretary also submitted a recommendation from the Council that the next show of vegetables and flowers be held in the Town Hall on Wednesday, the 13th of April. Agreed to.

CATTLE MURRAIN.

Read the following letter forwarded by the Government of Bengal in continuation of the papers submitted at the last meeting :—

FROM S. C. BAYLEY, Esq.,

Junior Secretary to the Government of Bengal,

TO DR. C. PALMER,

Presidency Surgeon.

Fort William, the 3rd March 1864.

General.

SIR,

I AM directed to forward to you a copy of the accompanying corres-

* Letter from Mr. J. Stalkartt, dated 3rd February 1864, with enclosure.

Letter to Mr. J. Stalkartt, No. 706, dated 10th February 1864.

Letter to Secretary, Agricultural and Horticultural Society, No. 705, dated 10th February 1864.

Letter from Secretary, Agricultural and Horticultural Society, dated 19th February 1864.

Memorandum by Dr. McClelland, dated 29th February 1864, with enclosure.

pondence, * and to inform you that the Lieutenant-Governor has been pleased to appoint you to conduct an enquiry as to the nature of the disease prevailing at present extensively among the cattle in Calcutta and its neighbourhood, and also as to the best means of effecting the cure of the disease and of preventing a further extension of its ravages.

2.—The Agricultural and Horticultural Society will be requested to co-operate with you as proposed in their Secretary's letter, and the Local Officers in Calcutta and the neighbouring Districts will be desired to give you every assistance in their power.

3.—I am to direct your attention to the correspondence which is about to be published in the *Gazette Supplement* regarding the Cattle Murrain raging in the Madras Presidency.

No. 1110.

COPY of the above letter forwarded to the Agricultural and Horticultural Society with reference to their Secretary's letter dated 19th ultimo, and their attention directed to paragraph 2.

FORT WILLIAM,

S. C. BAYLEY,

The 3rd March, 1864. }

Junior Secretary to the Government of Bengal.

IMPROVEMENT OF THE BREED OF NATIVE CATTLE.

The Secretary read the report of the Special Committee on the above subject.

The President explained that the Council had adopted the above report which had been at their suggestion slightly modified in respect to some of its recommendations. Since the Council meeting, however, a communication had been received from Government enclosing two printed letters, one from the Landholder's Association, and the other from the British Indian Association. It would be found that the latter very nearly approached in its purport to the report of the Committee which had just been read. To him it appeared that the report of the Landholder's Association expressed more correctly both the facts and requirements of the case. He then asked the Secretary to read this report and a lively discussion ensued which ended by a motion on the part of Baboo Pearychand Mittra "that the Committee's report be adopted."

The President then moved the following amendment :—" That this meeting desires to express its concurrence generally with the facts found and the recommendations made by the Landholder's Association in Mr. Beckwith's letter of the 27th February."

The amendment being put to the vote was lost and the Baboo's motion carried.

The following is the letter from Government enclosing the two reports above referred to :—

TO THE SECT. TO THE AGRICULTURAL AND HORTICULTURAL SOCIETY.

Fort William, the 14th March, 1864.

General.

SIR,

In continuation of the letter from this Office No. 981 T, dated 6th October last, relative to the best means of improving the breed of Bengal Cattle, I am directed to forward the accompanying copies of letters from the British Indian Association and Landholders' and Commercial Association, dated, respectively, the 5th and 27th ultimo, and to request that the Society will be so good as to favor the Lieutenant-Governor with an expression of their views on the subject.

2. I am to suggest to the Society the preparation of a brief Manual in Bengalee, Oordoo, and Oorya, calling the attention of Agriculturists to the importance of preserving and improving the quality of stock by carefully selecting Bulls for breeding purposes, and by reserving a sufficient quantity of land in each village for pasture, with practical suggestions to this end.

3. With reference to the recommendation of the British Indian Association in favor of Cattle Shows, I am to observe that the question will be taken up by the Lieutenant-Governor on the receipt of the Report which the Exhibition Committee have been desired to submit to Government.

S. C. BAYLEY,

Junior Secretary to the Government of Bengal.

The suggestion contained in the second paragraph of the above letter was referred to the Special Committee.

A Report was submitted by the Cotton Committee on various samples, exotic and indigenous, raised at Chingleput and forwarded by Dr. Shortt.

A Report was likewise submitted from the Tea Committee on Mr. Reinhold's translation from the Dutch, laid before the last meeting, of the concluding portion of Jacobson's Hand-book on Tea culture and manufacture as pursued in Java. The Committee recommend the publication of the translation in an early Number of the Journal. Referred to the Committee of Papers.

The following letters were also read :—

1. From Dr. H. Cleghorn presenting a paper by Mr. W. Coldstream, C. S., on the Economic Products of the Desert Tracts of the Mozuffurgur District. Transferred for publication in the Journal.

2. From Lieut. Colonel John Eliot, Royal Artillery, in reference to the result of his sowings of Carter's vegetable seeds of last season :—

"In compliance with your request that I would give you my opinion of the vegetable seeds sent over last season by Messrs. Carter & Co., I have much pleasure in informing you they were by far the best seeds I have ever received through the Society from England. I sowed seeds at Murree and I do not think any sort failed altogether, one sort of lettuce of (cabbage, I think) germinated very sparingly. The beet root also did not come up freely but all the seeds had a severe trial as it happened that after each sowing very heavy rain came on. The radish seed was very superior, the scarlet in particular, and I may add, that I have within the past few days received a letter from a friend at Rawul Pindie to whom I gave some seeds in which he writes "The broccoli from the seed you gave me is just come in, it is first rate, very close grained, and white; and comes in when all the Indian sown seed is out, the General (General Oaley) is delighted at it." There were two kinds the Walcheren and Carters, I think my friend refers to the latter. I have so often been disappointed by English seeds failing, that I was agreeably surprized at the goodness of the batch referred to: the vegetables from English seeds are so superior to those grown from any other."

3. From H. Reinhold, Esq., submitting translation from a French paper in reference to a very superior description of cotton which has been recently introduced from Borneo into Algeira; and suggesting that some enquiries be made respecting it.

The Secy. mentioned that from the description given, the cotton alluded to might prove to be of Brazilian origin. He had lost no time in acting on Mr. Reinhold's suggestion.

4. From Dr. Alexander Hunter, Secretary, Agri. and H. Society of Madras, returning thanks for the supply of Bael fruit recently sent and asking for a further quantity.

5. From the Secy., Cape of Good Hope Agricultural Society, in acknowledgment of the publications of this Society and expressing their readiness to reciprocate.

For the above communications and presentations, the best thanks of the Society were accorded.

(Wednesday, the 20th April 1864.)

A. Grote, Esq., President, in the chair.

The proceedings of the last monthly meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. E. G. Haddan, S. J. Leslie, G. E. Lance and Major R. Richardson.

The names of the following gentlemen were submitted as candidates for election :—

1.—Dr. J. M. Fleming, Humeerpore,—proposed by the Secretary, seconded by Mr. Grote.

2.—John Biddle, Esq., Proprietor N. W. Dāk Company, Umballa,—proposed by Mr. J. H. Allen, seconded by Mr. W. G. Rose.

3.—Nawaub Syud Ahmed Allee,—proposed by Baboo Pearychand Mittra, seconded by Rajah Suttoshurn Ghosal.

4.—Secretary Public Garden, Agra,—proposed by the Secretary, seconded by Baboo Pearychand Mittra.

5.—Moulavee Abdool Luteef Khan Bahadoor,—proposed by Rajah Suttoshurn Ghosal, seconded by Mr. Grote.

6.—Major W. B. Irwin, Stud Department, Poosa,—proposed by the Secretary, seconded by Mr. Rose.

The following presentations were announced :—

1.—Memoirs of the American Academy of Arts and Sciences, Parts 1 and 2 of Vol. VIII and a few numbers of its Proceedings, Vol V. From the Academy.

2.—A Collection of Treaties, &c., relating to India and neighbouring countries, Vol. V. From the Government of India.

3.—Memoirs of the Geological Survey of India, Palcentologica Indica 33. From Dr. Oldham.

4.—Third Annual Report of the Agri-Horticultural Society of Oudh, 1863. From Dr. Bonavia.

5.—Report of the Ooterparah Hitokorry Shova, for 1863-64. From the Society.

6.—A few Orchids from Sylhet. Presented by Major J. B. Thelwall, c. b.

7.—A collection of Cereals from England. Presented by Dr. J. B. Barry. The result of trial sowings of this seed in the Society's Garden was submitted by the Gardener; and as it is favorable, it was agreed to send a good portion of each kind to Major G. L. Brown at Dinapore, who had applied for some, on the understanding that he returns, in due course, some of the produce for distribution in 1865.

8.—A sample of Flax raised at Shajehanpore. From Mr. J. Powell.

Mr. Powell remarks that his plants were rather more than 4 feet high in the average all round ; and he has obtained two seers of fibre from 45 square yards of ground.

Mr. John Stalkartt submitted a portion of this sample in a heckled state. He stated that there was great loss in the process, owing to defective preparation ; but the fibre is good and the result he considered sufficiently encouraging to warrant an extended culture next season.

9.—A sample of Cotton raised in his garden at Allipore from seed said to be indigenous to the Rajmahal Jungles. From Mr. Grote.

Mr. Mosley reports on this cotton as not indigenous but a favorable specimen of New Orleans, a nice silky cotton of fair staple and fibre, value in the home market about that of middling Orleans, which a month ago was 27 *d* per lb.

10—Sample of cotton raised from Egyptian seed at the Rangoon Experimental Plantation. From Mr. Leeds, Officiating Conservator of Forests, Burmah. (Referred to the Committee.)

11.—A Burmese Cotton Gin. Presented by Mr. J. A. Crawford.

Mr. Crawford remarks that this Gin "is precisely similar to the one which was on show in the Burmese Dept. of the late Agricultural Exhibition, and to which a prize was awarded, as well for the efficient manner in which it did its work as for the simplicity of its construction and cheapness. It can be got for 4 Rs in Rangoon and after paying all charges of freight &c., it can be landed here as was this one for Rs. 7. I do not know what opinion the Council may entertain of its merits, but it appears that the introduction of some simple instrument like this would be of service to the people of the districts in which cotton is grown, and that it would be worth the attention of Landholders and others interested in the growth of cotton to introduce it to the notice of their ryots by means of models. I should think that even here the whole instrument could be manufactured at most at the cost at which it can be imported, or say Rs. 7."

It was agreed to test this machine with those recently imported and of local manufacture. In the meantime the best thanks of the meeting were accorded to Mr. Crawford for bringing it to notice.

HORTI-FLORICULTURAL EXHIBITION.

The following reports of the Judges on the show of the 13th of April were read :—

Horticultural.—Notwithstanding the lateness of the season, several fine baskets of various kinds of Vegetables were submitted on this occasion. Conspicuous amongst them were Potatoes, Cabbages, Turnips, and Carrots, both

Altringham and early horn. For the best specimens of each bronze medals were awarded in addition to money prizes. A good basket of Parsnip was also introduced. Asparagus, Globe Artichokes, Celery, French Beans, Beet, Onions and Leeks were fairly represented. Lettuce of middling quality ; curled Greens in pots very good ; ginger good ; Indian corn of good description, but not full grown cobs. There was also a small collection of native vegetables, not comprising any particular kinds.

Of Fruits, early Peaches, Sapotas, Loquots, and Pomegranates, were perhaps most worthy of notice. Rose-apples, Pine-apples, Guavas, Plantains, and some fine baskets of Bael were also placed on the stands, in addition to a few other of the more common kind, such as Papeeyas, Cocoanuts, Water Melons &c.

About 100 gardeners were in attendance, and prizes amounting to Rs. 166 were distributed to 37. Altogether, this show may be regarded as of fair average, and decidedly superior to that held in April 1863.

W. G. ROSE,
C. E. CRESSWELL,
PEARYCHAND MITTRA,
JOSEPH AGABEG.

Floricultural.—The Show held in April 1863, was considered as rather below the average of the late shows of previous years, both in the extent and variety of plants exhibited. This remark is not applicable to the show of the 13th instant which was better than many of its predecessors, though, perhaps, not equal to some.

Of Orchids, usually the most attractive feature at this last exhibition of the season, there was a fair collection from seven or eight gardens. In the collection to which the first prize was awarded there were sixteen kinds, including *Ceologyne Parishii* and *Saccolabium rubrum*. The second prize was given to a collection of nine kinds ; the third prize for five kinds. There were several fine grown plants of the gorgeous *Renanthera coccinea* and of *Phalanopsis amabilis*. The specimens of *Vanda teres* were very healthy, and probably, in more profuse bloom than previously exhibited.

The bulbous and tuberous tribes were pretty well represented. The best collection of Amaryllids consisted of eight kinds ; Gladioli of four kinds. Of Gloxinias there were some fine specimens. Begonias were indifferent.

There were some well-grown specimens of *Ixoras* of several kinds ; a few fine plants of *Stephanotis floribunda* and two *Fuchsias*.

There was a large collection of Pinks, Phloxes, Portulacas, Antirrhinums and Asters ; also several representatives of the Cactus family.

Next to the Orchids, the Caladiums and Ferns attracted most attention, the finest specimens being grown under glass : of the former there were 12 varieties and ten of the latter.

In the list of novelties were plants of *Maranta rosea*, *Pothos argyrea*, *Thyr-sacanthus sessiliflora*, *Sprekelia Dalhousianum*, a red *Hedychium* and *Erodium* species.

A pretty collection of plants was also submitted from the Society's Garden, not for competition, but for exhibition only. The assortment would have been larger but for the severe hail storm on the 24th of March, which disfigured several fine specimens and completely destroyed others. But for this storm it is probable many more plants would have been brought forward on this occasion from other gardens.

The prizes, amounting to Rs. 152, were distributed to 20 gardeners by Baboo Pearychand Mittra, Vice-President.

G. BARTLETT,
W. STALKARTT,
THOS. ANDERSON, M. D.

A report from the Committee (Messrs. Haworth, Stalkartt and McGavin) on sundry samples of Flax raised at Lucknow and submitted by Dr. Bonavia at a former meeting, was laid on the table.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following letters and papers were also submitted :—

1. From Lieut. Coll. J. C. Haughton, dated Cooch Behar, 25th March, applying for a quantity of Tobacco seed :—

“ This country, you are doubtless aware, is a great tobacco-producing one. I am inclined to believe that if attention was given to the matter superior tobacco might be produced, but as far as I can learn attention is only paid to the size of the leaf which rules the market value. Our tobacco no doubt is known in the markets of Rungpore. I shall feel much obliged for any information or hints for my guidance you can give me. The Ryots here mainly depend on the tobacco crop to pay their rents ; but recently have suffered much from the low value it bears in the market.

I propose while here to devote my attention to improving the staple if possible and bringing it into repute. I had intended to have tobacco show this season but the crop has been so damaged by hail that I fear the attempt must prove a failure if tried this year.

I shall feel obliged if you can be the means of obtaining for me a supply of Havanna and Manilla seed to reach this before 1st October next. I am prepared

to pay Rupees 100 for this object, but in any case will be thankful for the smallest packets of fresh seed for experiment.*

The Secretary mentioned he had sent Coll. Haughton a small quantity of acclimatized and imported Havana seed, and would send more on receipt of the new supply expected next month. He had also applied to Messrs. Russell and Sturgis of Manilla for a quantity of seed from thence.

2. From F. E. Moore, Esq., Personal Asst. Commissioner of the Punjab, dated Lahore, 29th March (in continuation of his letter read at the last meeting regarding cotton seed) of which the following is an extract:—

“So anxious is the Punjab to secure really good seed, that though the price of this, up to Lahore, has amounted to Rs. 24 for the two maunds I not only do not anticipate any difficulty in getting rid of it, but know that I shall be swamped with applications for more. I have made over what you sent me to Capt. Hall, Depy. Commissioner, Lahore, for distribution in this district to such parties as he may approve of and who he knows will be careful with the seed and plants. The best security we have is perhaps the fact that the seeds are not distributed gratis.”

“Could you further oblige me by procuring me from some of your known planters, directions for sowing cotton seed, I would make them generally known.”

The Secretary mentioned that he had sent the required information, and had been able, through the kind assistance of Messrs. Thomson and Mylne of Beheea (Shahabad) to send another maund of acclimatized New Orleans seed, in addition to the two maunds previously given, free of all charge, by these gentlemen.

3. From Dr. J. M. Fleming, dated Humeerpore, Bundlekund, 29th March, applying for acclimatized cotton seed:—

“Can you oblige me with about 20 seers of acclimatized American or other good cotton seed, for the Jail Garden at this station. I am anxious to introduce its cultivation by way of experiment, as I think a great deal might be done to improve the cotton of this district. Will you, at the same time, kindly inform me what you consider the most favorable time for sowing and what are the general precautions to be taken, or if you can recommend any book on the subject.”

“I trust you will excuse my giving you this trouble in consideration of the importance of the subject.”

"I may state that in the Humeerpore district the area under cultivation last year was 37,000 acres, and the estimated produce 18,000 maunds. It is sown late in the year broadcast, and never watered."

The Secretary stated that Messrs. Thomson and Mylne had placed him in a position to meet this request as respects seed: he had likewise given the required information.

4. From J. D. Ward, Esq, Magistrate of Chittagong, dated 15th March, respecting the best kind of grass for lawns and trees for the sea-side:—

"I should be greatly obliged to you if you would inform me whether there is any kind of grass seed procurable in India, which could be sown on a lawn."

"This station adjoins the sea and the soil is so sandy that good turf is nowhere procurable. There are several unsightly bare patches of ground about the town and I am anxious to try a plan of laying a stratum of good earth about one foot deep over them and then sowing lawn grass over the fresh earth."

"Would you kindly tell me your opinion of the practicability of the plan and also if you know where I could get grass seed."

If you know of any hardy plants that would grow in a dry and saltish soil and that might be used for ornamenting these patches; or, if in fact, any means of remedying the eyesore of which I complain suggests itself to you, I should be very much obliged to you indeed for your advice."

The Secretary mentioned that with the assistance of Dr. Anderson, Superintendent of the Royal Botanic Garden, he had been able to give the necessary information.

5. From Messrs. John Elliot and Co., submitting a plan and certain particulars connected with Wanklyn's cotton Gins.

6. From the Secretary Agri-Horticultural Society of the Central Provinces, forwarding the proceedings of a General Meeting of the Society held at Nagpore on the 11th of March 1864.

7. From the Secretary Madras Agri-Horticultural Society forwarding the Proceedings of a Meeting held on the 10th February 1864.

These proceedings contain details respecting Cottons, Imphee, Bael and Tea. The following hints respecting Tea seed may be serviceable to those interested in the culture:—

“The Secretary intimated that he had been informed by parties, who had been attempting to grow tea on the Neilgherries, the Shevoroy, and at Madras, that Tea seed is very liable to rot before it germinates, and that the best way to prevent this is to crack the shell of the Tea seed, place it immediately in a loose rather open soil in shallow large flower pots, apply steam below these pots for an hour every day, and about the 5th day the seed will begin to sprout. It is better to propagate Tea in this way than to sow seeds out, as many of them lie for months without striking. In six weeks or two months the young trees may be transplanted.

8. From Dr. H. M. Cannon, Inspector of Prisons, Oudh, a memorandum on the mode of cultivating cotton from acclimatized New Orleans seed at the Lucknow Central Jail, giving the amount and value of produce for one English acre. (Referred for publication in the Journal.)

9. From Messrs. James Carter and Co., London, dated 10th March, acknowledging receipt of order for vegetable and flower seeds, and promising to give it their best attention.

(Wednesday, the 25th May, 1864.)

A. Grote, Esq., President, in the chair.

The proceedings of the last monthly meeting were read and confirmed.

The following gentlemen were elected Members:—

Dr. J. M. Fleming, Major W. B. Irwin, the Secretary Public Garden, Agra, Nawaub Synd Ahmed Allee and Moulvee Abdool Lutteef Khar, Bahadoor:

The names of the following gentlemen were submitted as candidates for election:—

Dr. J. L. Stewart, Officiating Conservator of Forests, Punjab, proposed by the Secretary, seconded by Mr. Grote.

P. S. Melville, Esq., C. S., Commissioner Umritsur Division,—proposed by Mr. H. Cope, seconded by the Secretary.

R. Alexander, Esq. C. S. Cuttack,—proposed by Mr. F. W. Armstrong, seconded by Mr. A. C. Howard.

Captain C. P. Hildebrand, Deputy Commissioner, Margui,—proposed by Mr. E. G. Haddan, seconded by the Secretary.

Baboo Doorgapersand, Zemindar, Etah,—proposed by Dr. J. W. Tyler, seconded by Mr. H. A. Harrison.

R. Griffiths, Esq., Principal Queen's College, Benares,—proposed by the Secretary, seconded by Mr. W. G. Rose.

Donald S. Watson, Esq., Merchant, Calcutta,—proposed by Baboo P. C. Mitra, seconded by Rajah Pertabchunder Sing.

J. O. Watson, Esq., Merchant, Calcutta,—proposed by Baboo P. C. Mitra, seconded by Rajah P. C. Sing.

Major G. C. Haukin, Brigade Major, Ferozepore,—proposed by the Secretary seconded by Mr. Grote.

J. H. Thomson, Esq., District Superintendent of Police, Chyebassa,—proposed by Dr. W. H. Hayes, seconded by the Secretary.

W. Dodgson, Esq., Kallygunge Factory, Rungpore,—proposed by Mr. W. Stalkartt, seconded by Dr. C. Palmer.

J. Siddall, Esq., Veterinary Surgeon, Buxar,—proposed by the Secretary seconded by Mr. Rose.

Colonel Arthur Broome, Royal Artillery,—proposed by Mr. Grote, seconded by Mr. Stalkartt.

The following presentations were announced.—

1. The Annals of Indian Administration, Vol. VIII Part 1.
2. Annual Reports on the Administration of Mysore and of the Coorg district, during 1862-63, presented by the Government of Bengal.
3. Journal of the Asiatic Society of Bengal, No. 1 of 1864, presented by the Society.
4. Three healthy plants of Araucarias, viz., *exceles*, *Bidwillii* and *Cookii*, presented by Mr. H. J. Butler.
5. A quantity of Sandoway tobacco seed, presented by Mr. H. W. Beddy.

6. A quantity of Bhilsa tobacco seed, presented by Major Willoughby Osborne.

7. Seed of the Manipoores *Hungam*, presented by Capt. R. Stewart, Supdt. of Cachar.

Captain Stewart describes the *Hungam* as a very fine vegetable that grows in Cachar; but which is absent from kitchen gardens in general. "It is first sown in seed beds and then transplanted in the same way as cabbages, &c. The soil should be rich alluvial manured with old cow dung and ashes. The seed should not be sown till after the rains. The vegetable as greens is a most pleasant and sweet one for the table, and has none of the rank taste so common in native vegetables."

8. A small quantity of cotton in boll raised at the Rangoon experimental plantation from acclimatized New Orleans seed obtained by Dr. Brandis at Lucknow in November 1863, forwarded for report by Mr. H. Leeds, Officiating Conservator of Forests, British Burmah.

RECOMMENDATIONS FROM THE COUNCIL.

The Council submitted the following recommendations:—

First.—That Mr. J. A. Crawford be elected a Member of the Council, in the room of Mr. Stewart Douglas, who has left India.

Second.—That Mr. Joseph Agabeg, be elected a Member of the Cotton Committee, in the room of Mr. W. S. Fitzwilliam, who has left India. The above two nominations were agreed to.

Third.—That Captain W. H. Lowther and Mr. James Cowell be proposed as Corresponding Members, to be balloted for at the next monthly meeting.

Fourth.—That the names of the 17 Members, as per list furnished by the Finance Committee, whose subscriptions amounting to Rupees 2,231 are considered irrecoverable, be expunged from the list. Agreed to.

Fifth.—That a portion of the sum of Rupees 3,000 now at credit of the "Grant Testimonial Fund" be appropriated for the manufacture of a die for a medal to be styled "the Grant Medal" to be awarded for such objects as may, hereafter, from time to time, be determined on. In preferring this recommendation the Council are merely resubmitting a proposal made at a meeting of the Society held so far back as February 1849, but which has hitherto been in abeyance, in consequence

of the amount at credit not being sufficient to carry out the contemplated object. Agreed to.

A list of the flowering plants and fruit grafts that will be available on the re-commencement of the distributing season, 15th June, was submitted by the Gardener. A report from the Committee on sundry samples of cotton, which were received last year from Banda, Agra, Furreedpore and the Punjab, was laid on the table. Transferred for publication in the Journal.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following letters were also submitted :—

1.—From Dr. J. L. Stewart, submitting a paper on the Bijnoor forests and their trees with an account of their useful products.

2.—From C. Brownlow Esq., a paper on the timber trees of Cachar.

The above two papers were transferred to the Committee for publication in the Journal.

3.—From Dr. Geo. Henderson, Shahpore, Punjab, dated 8th May, intimating that he will, probably, be able to distribute a quantity of acclimatized New Orleans cotton seed at the end of the year. "In case you have any applications for foreign cotton seed,"—writes Dr. Henderson—"from this part of the country, I may mention that, if the season turns out at all favorable, I hope to have 20 to 30 maunds available for distribution in November next. The principal sorts are New Orleans and Mexican, a little Egyptian and a few seeds of two kinds of hybrid cotton, crosses between New Orleans and Egyptian. New Orleans cotton has been acclimatized here for 30 years at least, and does not appear to have degenerated in any way. The Zemindars have the impression that the yield is rather less than from country cotton and hence it is only grown for home use by Lumberdars."

4.—From John Powell, Esq., Rosa *via* Shajehanpore, 12th May. In reference to the flax of which a specimen was submitted and reported on at the last monthly meeting :—

"I am much obliged to you for sending your letter of the 30th ultimo.

It is satisfactory to know that the fibre of the flax was good, as that was the main consideration, the defective preparation can be remedied. And now will you kindly let me know how the fibre should be separated from the stalk so that I may obtain it in such a state that there will be but little loss in the heckling.

I had planted altogether about $\frac{1}{4}$ th of an acre. It all grew an average of above 4 feet in height, some I cut before the seed was ripe and a portion of the fibre obtained from this was sent to you. The rest I allowed to ripen, then crashed out the seed and soaked the stems. I obtained as much fibre as from the unripe stems and in appearance there is not much difference between the two.

The stems were soaked first, precisely, in the same manner as hemp, and when sufficiently rotted were treated similarly too, *i. e.* they were taken out of the water, allowed to drain a little; and then, with a forward push in the water the fibre was separated from the lower portion of the stem; if it did not all go back and leave the stocks bare a little rubbing was resorted to when it was put to dry and when dry the white stocks were drawn away. The produce per acre was 2 mds. 10 srs. of fibre and 3 mds. 30 srs. of seed.

The seed sown came from the Botanical Garden at Saharunpore and it appears was originally imported from Russia.

Mr. Stalkart will be able to say what quantity of clean fibre would be left of the 2 mds. 10 srs. and also what the clean fibre would be likely to fetch in England per ton.

Will you also please to mention whether there be any other approved way of separating the fibre from the stalks otherwise than by soaking for several days. This is rather an offensive process and is a consideration where there is not a large body of pure water in the shape of a river to carry away the tainted water of the tank.

The Secretary mentioned that he had afforded the information desired.

5.—From Dr. F. Muller, Superintendent Botanic Garden, Melbourne, dated 24th March, intimating that he has instructed Messrs. Law and Co. to undertake the Society's order for a collection of seeds of field crops.

6.—From Dr. F. J. Mouat, Inspector-General of Jails, Lower Provinces, requesting the Society's assistance in obtaining the usual annual supply of seeds for the Jail Gardens.

The Secretary intimated that he had taken the necessary steps to meet this request,

Monday, the 20th of June 1864,

Baboo Pearychand^{*} Mittra, Vice-President, in the chair.

The proceedings of the last monthly meeting were read and confirmed.

The following gentlemen were elected :—

As Ordinary Members. Dr. J. L. Stewart, Captain C. P. Hildebrand, Baboo Doorgapersaud, Messrs. P. S. Melville, C. S., R. Alexander, C. S., R. Griffiths, Donald S. Watson, J. O. Watson, J. H. Thompson, W. Dodgson, J. Siddall, Major G. C. Haukin and Col. Arthur Broome.

As Corresponding Members. Mr. James Cowell and Captain W. H. Lowther.

The names of the following gentlemen were submitted as candidates for election :—

Rivers Thompson, Esq., C. S., Kishnaghur,—proposed by Mr. A. Grote, seconded by Mr. J. Crawford.

Secretary of the Agricultural and Horticultural Society of Bhaugulpore,—proposed by the Secretary, seconded by Mr. W. G. Rose.

Thomas Baker, Esq., Anjooree Tea Plantation, Jorehaut,—proposed by Mr. R. V. Doync, seconded by the Secretary.

A. Blandford, Esq., Indigo Planter, Futehpore,—proposed by Mr. W. Cumming, seconded by Mr. H. Maseyk.

E. J. Churcher, Esq., Mehndy Ghaut, near Kanonj,—proposed by Mr. C. E. Creswell, seconded by the Secretary.

Lieut. R. C. Beavan, Revenue Survey Department, Barrackpore,—proposed by Mr. Grote, seconded by Mr. Crawford.

John Macdonald Campbell, Esq., Tea Planter, Dyapore Concern, Cachar,—proposed by Mr. A. S. Campbell, seconded by the Secretary.

E. Mackin, Esq., Manager Kemaon and Oude Plantation Company,—proposed by Mr. H. Cope, seconded by the Secretary.

The following presentations were announced :—

1.—The Annual Report of the Benares Agri-Horticultural Society for 1863-64 presented by the Society.

2.—Selections from the Records of the Government of India, (P. W. D.) No 40, presented by the Government of Bengal.

3.—Journal of the Asiatic Society of Bengal, No 2 of 1864, presented by the Society.

4.—A Wardian case of Orchids from Moulmein, presented by Captain W. Eales. Received in fair condition.

5.—Two plants of *Calogyne Parishii*, presented by the Revd. C. S. Parish.

6.—Four kinds of best description of Tobacco seed, from the Madras Presidency, presented by the Madras A. & H. Society.

7.—Seed of *Cassia Wallichiana*, presented by Mr. Grote.

8.—A few tubers of the New Zealand yam, presented by Mr. B. S. Collins.

9.—A small quantity of Cotton seed from Borneo, presented by Mr. H. Reinhold.

This is the Cotton referred to in Mr. Reinhold's communication submitted at the Meeting in March last. It is evidently of Brazilian origin.

10.—A specimen of Cotton and a small quantity of seed from Dinagapore, raised by Mr. D. B. Nicol, presented by Mr. Duval. This Cotton has been raised from acclimatized New Orleans seed. It is of good quality and valued, fully, at 2 shillings per pound.

11.—Seven kinds of Cotton seed, viz: New Orleans, Peruvian, Mexican, Brazilian, Egyptian, Venezuela and Tree Cotton, forwarded Overland, from the East India Museum, by Dr. Forbes Watson.

The following is an extract of Dr. Watson's letter in reference to the "Tree Cotton":—

"The 'Tree Cotton' is from Equador. It is perennial and said to grow to the height of from 12 to 14 feet. It will not yield till the 2nd year. It was accompanied with two samples said to be Kapass from the same seed. The one on ginning gave 39 per cent of clean Cotton to seed, the other as much as 47 per cent. Notwithstanding the loss of the first year, and the trouble which it will involve to keep the plants alive, it appears to me well worth a trial, and I shall be glad to hear the results of such experiments as you may cause to be made with it. I had its Cotton valued in Manchester on the 18th of this month. The Report states it to be a clean strong coarse but useful Cotton worth from 24d. to 25d. per pound."

The Secretary stated that, with the exception of the Mexican and Brazilian, these seeds had germinated freely in the Society's Garden.

A Report was submitted by a section of the Committee, (Messrs. Mosely and Agabeg) on the samples of Cotton from Rangoon and Lucknow, which were placed on the table at a previous meeting. Both cottons are favorably reported on.

PRIZE ESSAYS FOR THE CULTURE AND MANUFACTURE OF TEA.

The Council submitted a recommendation for the offer of two prizes of Rs. 500 each, for the best treatises on the cultivation of the Tea plant and manufacture of Tea, as applicable to the Hills and Plains; together with details of the contents of such treatises, which must be sent in not later than the first of March 1865. This recommendation was adopted and due publicity directed to be given to the offer.

Read a letter from Col. J. C. Haughton, Supt. of Cooch Behar, applying for seed potatoes from English stock, with the view of improving the local stock.

"I shall feel obliged" writes Col. Haughton,—“by your becoming the means of obtaining for me four packages of seed potatoes of such kind as you may deem best from England, to arrive say first week in November. The packages to be of such weight, as if necessary, to admit of their being forwarded by Dāk. I am of course prepared to meet all expenses and if you see fit to name any sum as the probable amount to be disbursed, I will remit it in advance.”

“I am induced to make this exertion to improve the local stock, as the potato is cultivated to a considerable extent here, and the produce is palatable though small. It was introduced about 70 years ago, by order of the Board of Revenue, who sent up 60 mauuds of seed, hoping the introduction of the root would furnish the people with a means of support in case the rice crop should fail.”

Agreed, that every assistance be rendered to Col. Haughton in obtaining a superior kind of potato.

Read a letter from Dr. John Short, of Chingleputt, intimating that the Manchester Cotton Supply Association had suggested to him the advisability of writing some easy work on Cotton Cultivation for the use of the Ryots, and that he thought it would be better if his Essay on Cotton Cultivation were translated into Hindustanee, and Tamil; but that as he has not the means of undertaking the translations he should be happy, with the permission of the Society and its patronage, to make the translations in question. It was agreed on the recommendation of the Council to grant the necessary permission, but not to expend any sum on the translation of such a work into Hindustanee, as it would not be appreciated by the class for whose benefit such translation was proposed.

Before the meeting broke up the Secretary read a letter from Capt. W. H. Lowther, to the address of the President, descriptive of the Scenery and Flora of the Shevrong Hills, of which the following are extracts :—

A considerable change of weather has taken place here and I am disappointed with the climate. When the wind is easterly we have a very bad wet day, and it seems to spring up out of the foggy *Khuds* and hollows for which

the Shevoroyes are more celebrated than for running water. Contrary to our N. W. Himalayan abundance of water on the tops of Mountains, *here* the pure sparkling element is sadly deficient, and I am compelled to filter all that passes our lips. The rain-fall is pretty regular and continuous, or no coffee would grow nor would there be Flower Gardens. A deficiency of labor seems the great draw-back to civilization *here*, as elsewhere. This year the Coffee crop will be superb and just the reverse to the "*oranges*;" for want of adequate communication, 9 Rupees the thousand is not always obtainable for the latter fruit! Peaches and pears seem to have been better off, and the trees are loaded with the latter. Apples are not plentiful though *good*, just for want of Gardeners and no other reason, and so with many other fruits. I hear of Rupees 4 per 100 being the usual price of these Apples. The *grape-vine*, strange to say, will not grow, it seems strange to me, and I say they have tried the *wrong* kind from the *wrong* place; the Cape kinds, I know would do well, and I have suggested the Hop. I was delighted to find a clump of the real Assamese Tea Trees in all their pristine vigour and luxuriance, tall, unpruned, unmolested, specimens, such as we have in the Mishmee frontier on the classical Koonail of Assam. The seeds I am told were selling for the Neelgherry plantations at Rupees 10 the pound weight last season. There is some pretty scenery around us here. Pagoda point is a wonderful piece of panorama; from a precipice nearly 5,000 feet perpendicular, you can scan the arid and boundless plains of a whole Province at a glance,—an interesting spot covered with primitive sacrificial altars, slabs and uncouth Temples of an Aboriginal people,—the "*Mulharees*," Here and there in lonely spots, on these hills, there are "*Cairns*" or "*Cromlechs*" as in Europe, some of which have been opened under Archaeological patronage and disclosed very interesting relics. In a particularly large one near my residence were found (below the usual fine slabs of stone) a sickle, whet stone and sepulchral urn, the latter gradually dissolving away as it stood exposed to the atmosphere. I am sorry to say our abundant showers and fogs have produced but little in the way of flowers or shrubs. The *Asparagus racemosus* 12 feet high is the chief creeper at present in full flower, and the little shrubby *Asp: adscendens* is equally common, and nearly as fragrant. Ferns of the rock loving order and Parasitic (as in N. Assam) are springing up. *Berberis Asiatica* is common, the climbing *Mussaenda*, also a very pretty *Myrsine* like our N. Indian (*Burjam*) and I am promised a specimen or seeds of a Creeper, which by description I have never seen, and which must be splendid. Another pretty place is the "Green Hills" 5 miles off chiefly inhabited by E. Indian Coffee Planters, but the Collector of Salem, is building a house there: these Hills are far more salubrious than these, the slopes bare of bush or jungle: a new Temple on a gigantic scale on the summit visible

many miles' off, and the only running stream (a brook) in all these Hills, near it. This small Sanatorium is now nearly full.

I forgot to tell you in my last, that at Madras, I found some fine things in the so called Botanical Garden.—There are two European Gardeners (one just arrived from England) though the grounds as you know are on a diminutive scale, however, you will get a view of the finest *Hoya Imperialis* (Borneo) you can imagine, and what is more, get rooted plants of it at 3 annas each, and your climate and situation, shade, &c., are just the thing for this lovely *Exotic*, the King of the "*Hoyas*." You will find there some beautiful trees of "*Cathartocarpus Borburghi*" (elegant drooping Cassias with rose colored flowers) from Ceylon, and many other novelties. Sir W. Denison takes a great interest in introducing vegetation and a Cotton Field has been attached; fine specimens of the fibre are in exhibition under glass cases in the gardens, no less than 15 kinds, some of which have fetched prizes. I wrote to Dr. A. Hunter the Supdt. on the subject and got permission to purchase small samples and seeds of (6) *six kinds* (all that they can spare until fully introduced) of these the "*Queens land*" was beautiful, staple, long, fine and silky. I have sent the batch to Borradaile's Firm and recommended them to try the seeds in their Sunderbund grant at Mutlah as the best place to my thinking for an experiment, for their other cottons have done well *there*. I send you some freshly gathered seed of *Paspiflora*, now the weed and undergrowth of these hills and said to have been introduced. I think this is *P. albida*, a S. American, color *white*, a pretty Creeper to contrast with all the colored species as it is *Snow white*.—I have collected a large packet of *Tangier Pea* seed grown here and a few others; but as they cannot be sown till the cold season or at all events till October, I will reserve your portion for the future. All the flowers of warm and temperate climes do well here, but the natives of *wintry* places do not; thus all the Californian, the S. American and Summer flowers of Europe thrive or attain great beauty, while Stocks, Wall-flowers and such out-door *hardy* plants remain stunted and poor. It is very much the same in Bengal. Your *Ipomopsis* being a N. American plant had but little chance of germinating in such hot months. Being of the *Phlox* order it is impatient of moist heat; from October to April it might succeed. I got a long letter lately from my Horticulturist correspondent in the pleasant Valley of Utenhage, S. Africa, and it appears a ship had been wrecked with a fine collection of seeds for me, which is very vexations. I have been sending things from Madras even, since my arrival in the Presidency, and among my latest dispatches from Bengal was the very fine lot samples of Wheat from your exhibition packed with a little *Quick-Lime*, which has the virtue of killing all Weevils coming through it, and should always be used with *Leguminous seeds* as well as *Cereals*.

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OF
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The Timber trees of Cachar.—By C. BROWNLOW ESQ.

THE forests of Cachar are divisible into three sorts each possessing well-marked characteristics and easily distinguishable from the others,—upland forest, alluvial forest and swamp forest.

It is not easy to say what constitutes the exact difference, which however is very perceptible to the eye, between upland and inundatable alluvial forest; they have a good many plants in common *e. g.* bamboo, Chām, Goollee ratta; such plants however as in their natural distribution prefer the uplands occur but sparsely on alluvium, and vice versâ, and probably no plant occurs in equal abundance on both.

Each species of forest has thus a distinctive character. Tea itself is occasionally, though very rarely, found in a natural state on alluvium, but the conditions are evidently not such as to ensure its secular welfare, and such isolated trees as there may be are unsurrounded with offspring; whereas in the more congenial and well drained soils of disintegrated sandstone, clay state, and lava, the trees are almost invariably surrounded with a more or less numerous

progeny. *Dillenia speciosa*, *Andrachne trifoliata* and some others are exclusively lowland trees; as Nugussur, *Mesua ferrea*, some species of oak, and chestnut and others are exclusively upland.

Upland forest produces the best qualities of timber, the hard wooded sorts show a preference for it and thrive best on it, except Jarool (*Lagerstrœmia Regina*) which prefers alluvium, and if it grow on uplands must have its roots within reach of bog moisture.

In alluvial forest soft wooded trees and succulent climbers predominate; the interspaces between the trees are choked with canes and other rampant growing plants, and figs and a large leaved species of nettle are of frequent occurrence. Where drainage becomes very defective the forest gives way to Ekur grass, (*Saccharum*) Null (*Arundo*) Elephant grass, (*Typha elephantina*) the Seetul puttce rush (*Phrynium dichotomum*) and various other moisture loving plants.

Swamp forest is composed of crooked stunted species few in number and none of them useful for practical purposes except Moroc, an *Acacia*, which occurs in forests of its own species at the edges of beels, and in places where great depths of water do not prevail for long periods together. Pani Jam, Heejol, and a few other species, occur chiefly in the embakments of uplands where the trees have more or less water to stand in all the year round, and if submerged are only so for short periods and at high floods.

Forests are a good deal modified in their character by that cutter of wood and burner of jungle—man. In the vicinity of cultivation, and particularly where water carriage is at hand, all the larger and more valuable species of timber are certain to be removed, and much of the smaller sorts also, for posts of houses, firewood &c.; the effect of this thinning out is to let in light and air and to give room, so that the remaining trees have a tendency to branch out nearer the ground and to throw out root and stem suckers, thus losing much of their

value as timber. Where this process of interference has gone on for two or three generations the forest at length totally disappears, and its place is supplied by adventitious plants, by dwarf grasses most of which have no place in the original forest, or else by a low scrub of dwarf and hardy plants. In uplands where the hardy Ooloo grass, Lalang of the Straits, (*Imperata cylindrica*,) has once got fair hold, owing to over-cultivation and to the villagers having encouraged the crop by yearly burning, it excludes all other vegetation, and soon, by its close, impervious and binding system of roots, strangles such as may have survived. In forest shade it cannot make headway and soon languishes and disappears.

Among the agents in modifying the character of upland forest must be reckoned the Kookees and other upland cultivating tribes, the yearly devastation of timber produced by whom is enormous; wherever they "thoom" i. e. cut down, burn and cultivate, the destruction of timber is wholesale and complete: the conflagration produced by the undergrowth of bamboos and saplings, not in itself sufficient to kill the trees, is aided by lopping the boughs of the trees themselves, and thus but few trees and those generally of inferior sorts, recover, and a wide waste of bleached and rotting trunks is left, which fire, creeping in sooner or later, finally destroys.

The land after being cultivated two or three years, by which time it is so impoverished and acquires such a propensity to weeds as to afford no adequate return, is thrown up, with the character of its vegetation totally changed. A species of bamboo, the roots of which penetrate upwards of three feet into the ground and which spreads both by seed and underground runners, springs up and soon occupies the land to the exclusion of everything else, rendering it perhaps impossible that the forest should ever resume its original character.

It is high time, now that the district is being rapidly settled, that some sort of forest conservancy be instituted, particularly in the neighbourhood of rivers, streams, and streamlets. The

banks of the Katakhal river have for three or four days journey upwards, been totally denuded of timber, and if the Kookees and Dooshais be allowed unrestricted freedom in the choice of their *jloom* lands it may safely be predicted that the supply of timber to the sawmills of Cachar will hereafter, and that in no long time, be seriously impaired. The season during which the cutting and dragging of timber is performed is during the cold months; the elephants are able during this season to penetrate great distances into the forest; the timber is cut as close to water as possible and is then dragged the remainder of the distance or to the margin, so as to be readily launched when the rivers rise, *i. e.* in April and May; from this time till September, when the final subsidence takes place, rafts of timber are constantly passing down, buoyed up more or less with bamboos according to the specific gravity of the timber conveyed.

As the future supply of sleepers for Indian railways is becoming an important question it may not be out of place to mention a few of the timbers that would be suitable for that purpose. Nugussur, Bhashka, Awal, and other first class timbers are altogether too limited in their distribution ever to make it possible that they should be used exclusively; and Jarool, a desirable timber in other respects, is too much in demand for other purposes, amongst which is boat building, for which its lightness and durability in water peculiarly adapt it. There are however many other timbers that would be equally well adapted for sleepers, but which are in no demand, and indeed unknown at present, owing to natural crookedness, great specific gravity, difficulty of sawing and other disadvantageous qualities. These qualities are sufficient among the natives totally to interdict timbers which nevertheless would answer admirably for sleepers, and what is of almost equal consequence would, taken one with another, be found in sufficient quantities in any forest land to pay for the cutting and bringing out.

Boorha, (a species of wild Litchi) for instance, is a wood of equal durability with Jarool for out-of-the-water purposes ; it is exceedingly abundant and yet it is scarcely known except to the wood-cutters, all because it is only procurable in short lengths, being naturally crooked, and because it is somewhat too heavy to be convenient to the raftsmen ; the lengths however are not too short for sleepers, and it is on this very account viz. the lengths being short, that the wood-cutters might the more easily be induced to accept contracts ; the labour to their elephants would be less, since with these animals in timber dragging it is the weight that kills.

Cham, (*Artocarpus chaplasha*) an abundant, durable and light timber, is scarcely brought out owing to its huge size ; this is another timber which if cut up into short lengths would be accessible for sleepers ; similarly with Ramkota and other oaks.

Many fine and durable Acacias, Mimosas and myrtles, are passed by by the wood-cutters unheeded solely because there is no demand for them, their good qualities being only known to the dwellers in the vicinity of jungle tracts.

But if Railway boards expect to sit still and that the timber will be brought to their doors, they may wait long enough ; they must take the initiative, and make an energetic move, they must send people up to Assam and Cachar, to induce the wood-cutters to undertake contracts on, if necessary, advantageous terms at first ; they must erect a sawing establishment or two at the mouths of large tributaries such as the Diping Dekho or Borak, and when once the feasibility of the scheme has been proved they may withdraw their hands and it will work of itself.

As before mentioned it is not in the first class of timbers, such as Nugussur, Bhashka, Awal, Kyengla, Mhowhordol, that a main supply of sleepers can be looked for ; their durability is great, and many of them would not require renewal for twenty years :—but on the other hand they are none of

them to be found in sufficient abundance, Nugussur and Bhashka do in some places stand thick together, but such tracts are few and far between, and would soon be exhausted under a large and steady demand.

Timbers possessing an average durability of five years are much more common, and it is to this class that a steady and permanent supply of sleepers must be looked for. The following list comprises some of the trees of whose durability in the open air and on the ground we have satisfied ourselves by personal inspection.

The Boröes, the Boorhas, the Poomas (*Cedrela*) (a very numerous class), the Rattas, Moröe, Bharenga, Kyenglas, Peeplah, Ping, Ramkota, the Chams, Gamire, a good many of the Jams (another numerous class) Kalakhooras, the Hoon-dees, and several others. A third class possessing a durability not much exceeding that of pine is too numerous to detail here: but specimens of most of them may be seen in the Rooms of the Agricultural Society in the Metcalfe-Hall.

The roots of trees growing on uplands, especially if these be steep, are very superficial, and as there is no rocky substratum in the crevices of which they might find a purchase, they almost invariably on a steep hill lose the perpendicular and incline outwards from the centre; the constant wash of soil from about the roots during heavy rain further impairs their stability: when the deviation from the vertical is very great the trees endeavour to restore themselves and thus grow bent, and out of shape, in some instances the bend amounts to almost a right angle; under these circumstances it is seldom that a tree attains its full girth and dimensions, it has a tendency to stunt, and flaw, and generally produces inferior timber.

Good timber is also seldom found in very aged trees, even though these should be of the best sorts; trees in advanced age are very liable to become flawed, and hollow, the way in which this generally takes place is by the injury or fracture of

a bough close to the trunk either in high winds or by the falling of other trees, the snag gradually rots and communicates the canker to the interior of the tree; when once a cavity has been formed in which water can lodge the progress of decay downwards is rapid, it is a long time however before the caries reaches the alburnum and bark, to a sufficiently large extent to affect the vitality of the tree, and thus a tree to all appearance green and fresh will, when felled, turn out hollow and worthless. Ping, Nugussur and Lall Jhabash, are peculiarly liable to this form of decay and should always be inspected. Should a snag be perceived above among the boughs, the tree is not worth the cutting down. Kurrul does not become hollow but rots down one side.

The result of girdling or ringing is in the climate of Cachar very uncertain and depends entirely on the depth of sapwood cut into; if the bark be merely removed scarcely ten per cent of the trees will die; this uncertainty is especially remarkable in the case of most deciduous trees which retain their vitality and quickly form a callus on the upper edge of the ring indicating a readiness to strike from pole cuttings.

The Amrah it is scarcely possible to kill at all by ringing, even though it should be cut half through.

The resinous trees, with few exceptions, die both above and below when girdled to even a small depth, and those that do live below reproduce but feebly.

Trees which during the dry months cast their leaves and become bare before putting on their new foliage are few in number compared with those which retain part of the old foliage whilst putting on their new. Some part with their foliage more readily from the upper branches than from the lower.

The Amrah, Toollah, Batt Phooair, and some others become perfectly bare both top and lower branches and remain so sometime before the new foliage shows itself.

An unusually dry season will cause some trees to become

deciduous which are not so naturally, thus in the drought of 1853 the indigenous tea tree cast its leaves, though not the China.

The more perfectly deciduous trees are mostly soft-wooded and worthless under exposure. There is no month of the year in which some trees do not flower or ripen their fruit ; but the flowering season par-excellence consists of the months of March and April during which by far the greater number of forest trees come into bloom, some, as the Amrah, require a whole year to ripen their fruit, others ten months as Tea, the Horreesh, an Acacia ; but the greater portion drop their fruit at various periods during the ensuing rains.

When land has been cleared by burning, or otherwise, of the original forest, plants make their appearance some of which are entirely adventitious and not to be found in the original forest ; and of trees which are so to be found, some have so to speak a greater propensity to spring up on such sites than others ; the character of the ensuing is also affected by other such circumstances as the land being upland or alluvial, dry or wet, being cleared with or without fire, and finally by the degree of exhaustion by cultivation. On some fertile bottoms a species of spearmint, sowed apparently by overflowing waters, makes its appearance in dense tracts on the land being cleared ; this weed is very rapid in its growth, exhaustive, noxious and difficult to eradicate. Where very luxuriant however it indicates rich soil.

Moolee bamboo, an upland weed which, unlike the clumping bamboos, covers the land at uniform distances, seems to indicate repeated recurrence of cultivation ; several "jhooms" are necessary to produce it ; it is rather difficult to understand how, without the agency of birds or animals, it should come to be sown, as the seeds are the size of a man's fist, but once established it does not take long to spread by means of its underground runners. This bamboo seeds yearly instead of at intervals of several years as in the case of the

village bamboo. Some lands, both hill and low, come up immediately on being cleared in wild plantain, the plants first come up as close as they can stand and afterwards become thinned out by natural interference. In some new clearances large patches are occupied by Lokhanattee a wild fibrous plant (*Urera lobata?*) of which the natives sometimes make a sort of jute.

Traces may be seen on some uplands, that are not very far removed from the Bengali villages, of a former cultivation of cotton by Bengalis; this mode of cultivation has we believe in a great measure ceased now; it differs from the Kookee mode of cultivation of that staple in the selection of bamboo lands with as little mixture of forest as possible, the shade of which the Bengali, being no climber like the Kookee, would be unable to deal with. The Bengali does not scourge the land to the extent the Kookee does, but after taking off one crop, and that cotton only, allows it to relapse into jungle.

In consequence of the powers of the land being taxed to a less extent in this method than by the Kookee, the bamboo weed which attends the Kookee cultivation does not appear, but instead of it the land becomes covered with either the original clumping bamboo, or with forest* in which the trees are mostly of small size and girth, and are interspersed with species of bamboo reed (Rewah). Northern slopes, especially if at all steep, are not interfered with by the cultivators as on such slopes the cotton neither grows well nor bursts its bolls, hence they have an appearance of being more thickly wooded by nature than other slopes, which there is no reason to suppose they are.

The following is a list of fruit trees which have wild congeners in the Cachar jungles and would probably admit of being grafted the one on the other:—

The Jack on the Cham, the Litchee on the Boorha, the orange on the wild citron, the Puneela on the Lookdookce Jam, the

* Consisting of Mallee, Koorkooree, Oojah and various other plants.

May mango on the Botõe Am, the upcountry February mango on the Luckee Am, the cultivated rose apple (Gholabjam) on the wild rose apple, (indeed the fruits of these are so similar as to size and sweetness that there can be little doubt of the village trees being raised from jungle seed,) the cultivated Jamoon on the wild Jamoon, the Mangosteen on the Cowa, the Lutkun on the Boobee, the cultivated Amrah on the wild Amrah. Some of these unions might be productive of great practical benefit; the Jack tree for instance is of very slow growth requiring ten years to arrive at maturity. Now full grown Chām trees occur in great numbers in any upland forest, if then these could be headed down and grafted with Jack, the result might be trees yielding fruits in two or three years instead of ten, which it is needless to say would be a great boon to the natives who, when this fruit is in, look to it for a considerable portion of their subsistence; the natives recognize the affinity between the Jack and the Chām and call the fruit of the latter also by the term “ Kutthul. ”

The following list of Cachar timbers does not pretend either to exhaustiveness or accuracy. It is intended more as a practical guide than a botanical compendium; the Writer has in the arrangement mainly depended on Voigt's *Hortus*, and Master's list of Assam plants, and has in a few instances only, owing to a want of knowledge of structural botany, ventured to assign places to trees, and only when the resemblance in habit to known types was very marked. The natural arrangement was only adopted because it would seem in many instances to afford a clue to the quality of the timber, a consideration which was paramount.

Great difficulty was experienced in many instances in identifying trees owing to the native name varying in different districts. Whoever would form a comprehensive list of synonyms would be doing an inestimable service to the cause of Botany in India.

Magnoliaceæ.

Champa (*Michelia champaca*),—cultivated by cuttings in the village for the sake of its flowers; the soft white timber answers well for in-door work off the ground. Sopa of Hannays Assam list.

Dilleniaceæ.

Chelita, Bon Chelita, Chelita bonak.—Chelita (*Dillenia speciosa*), has large ribbed leaves, in erect tufts, which give it a very marked appearance; the fruit is large, imbricated, of an acid flavor, which makes it a favourite ingredient with the natives in their curries; flowers large and elegant. This tree affects lowland, and thrives even in swampy places, fed on by the Atlas silk worm, timber in no great repute.

Combretaceæ.

Hurtuki,—a good and durable timber answering well for in-door work; the seeds of the jungle Hurtuki are much larger than those sold in the bazaars, the tree that bears the latter does not apparently exist wild; the jungle nut is used by the natives for coughs.

Myrtaceæ.

Naguruttee Jam, Lall Shabash, Borputtee Jam, Polta Jam, Corunda Jam, Rangi Jam, Kali Jam, Phootee Jam. An excellent class of timbers, being of a straight grain and procurable of great lengths, they are likewise abundant and constitute a large proportion of upland forest. The heart wood of Naguruttee Jam is reputed equal to Nagessor, which indeed the tree very much resembles in external appearance. The bark and fruit of Borputtee Jam are highly astringent; the wood splits evenly and would probably answer for shingles. Lall Shabash frequently occurs hollow in advanced age.

Flacourtiaceæ.

Looklookee Jam,—the stature of this tree is too small to make it worth while taking the timber, even if it were abundant, which it is not; the fruit, the Panecala of Bengal, is a favourite with the natives, and is cultivated in the

village, the cultivated fruit is somewhat finer than the jungle ; the trunk of the tree is armed at all points with most formidable quaquaversal thorns.

Bixads.

Bilati Huldi (*Bixa orellana*) Arnott. — This tree does not appear to be indigenous as I have never met with it in the jungles, it is cultivated chiefly about Muniporee houses for the sake of the dye.

Garciniaceæ.

Bhashka, Nagessor, Kaoww, Dan kaoww, Dephol. All except Nagessor are gamboge yielders. Bhashka and Nagessor rank in the very first class of timbers for durability and closeness of grain ; unfortunately they are rather limited in their distribution.

The wood of young Nagessor trees is not lasting in the ground, but the heart wood of large trees is very enduring and suffers no perceptible decay in forty years, the white ants can make but small impression on it ; the flowers are large, white, with orange stamens and very fragrant ; the seed is oily and is cultivated for the sake of its oil in the Sylhet district ; the timber answers well for beams, but it is not employed by the natives in their own houses, as they have a superstition that it breeds dissensions in families. The resin would probably make a good substitute for Canada balsam as it has great viscosity, strength and clearness, and probably high refractive power. The acid fruit of the kaoww, (*Garcinia Coua*) is eagerly eaten by the natives. The leaves of the Dankaoww yield a pleasant acid to curries. The fruit called Dephol (which is distinct from that called by the same name among the bread fruits) yields plentifully, when cut in an unripe state, a yellow resin, which also exudes spontaneously and forms lumps resembling gamboge on the outside. Bhashka occurs in groups of 15 or 20 trees. It is preferable to Nagessor for beams and other purposes where rigidity is required being neither so elastic as Nagessor nor so liable to warp.

Ternstroemiaceæ.

Gooea Jam, Doli Jam. The leaves of Gooea Jam resemble those of certain varieties of the China tea-plant; the wood is used for churkoes for separating cotton from the seed. The leaves are fed on by the Atlas silk-worm. •

The Doli Jam is the common wild indigenous tea tree, so called from its white bark. Neither attain to a sufficient stature to be of any value as timber; the husks of tea seed would probably make excellent tanning material.

A species of *Camelia*, very closely resembling the China tea-plant, occurs wild in the Heemlah and Portabghur vallies as also to the eastward about Luckipore, but there seems to be an intermediate space including Hylakandy where it is not found; the natives frequently bring in the seed and try to pass it off for tea seed, and it requires some scrutiny to detect the fraud, the spurious seed is rougher and has more halves and quarters than genuine seed.

Aceraceæ.

Boröo, Kama Boröo, Tana Boröe.—A good class of timbers, growing very straight and of a good stature; their durability under the severest conditions *viz.* lying on the ground exposed to sun and rain, is from five to six years, and when charred externally they will last still longer. This Boröe is probably the Bon Boogree of Hannays Assam list; (see Journal A. and H. Society, Vol. iv. p. 117. and Vol. vi. p. 24.) In Cachar also it has derived the name from the resemblance in the leaves to those of the Bairoe *Zizyphus*, the seeds however have no resemblance, those of the Boröo being winged like the maples. •

Sapindaceæ.

Ooknee boorha, Lahooa boorha, Boobee.—The Boorhas are timbers of great durability but unfortunately have a tendency to grow crooked, gnarled and whorled; their grain is very involved so much so as to make it impossible to split with wedges, without cutting very deep furrows first; they

would probably answer for knees for ships even better than Jarool which they equal in durability. They are also worthy the attention of Railway companies from their abundance and regular distribution; their wood is very uniform, and even the boughs endure for 10 years under ground without perceptible decay. The Kookes prefer small boughs of this tree for posts in their houses to other timbers of three times the dimensions, as they both last longer, are stronger and more easily carried. I have picked up these posts in deserted villages and found them quite sound. The fruit resembles the litchi, but is smaller, the wild tree would probably answer as stocks for the cultivated.

The Booboo is the Lutkun (*Pierarlia sapida*) of Assam, the natives in cutting jungle leave these trees standing for the sake of the fruit.

Sterculiaceæ.

Heemool, Oodal, Toondoor, Heemlah.—Heemool is the Seemool (*Bombax heptaphyllum*), the wood is soft, easily sawn and of greater durability than is generally thought; when employed in doors and off the ground it is not like the Oodal liable to the attacks of insects. The rest of the species are only fit for tea boxes and such temporary uses. The bark of the Oodal makes serviceable ropes, which last 3 and with care 6 months. This rope is used in elephant khoddas as the tree is always to be found within a short distance. All the trees of this class are deciduous and flower in the hot season. The Seemool cotton is collected by the villagers for pillows and rozais and for this purpose the trees are propagated by pole cuttings along the banks of streams and other inundatable places. This class of trees attains to a very large stature. The Toondoor is known in Sylhet as the Sootrung.

Lythraceæ.

Lota Jarool, Gosa Jarool, Ramdallah, Jhalla.—The Jarools are excellent timbers for building and indeed all purposes; they are neat, work well, and are of great durability, they are

also very general and plentiful in their distribution, being probably the only really good timbers that grow naturally on low lands; although they thrive best, as indeed do all timbers, on the margins of uplands when their roots are within reach of alluvial moisture. They are also found in great abundance, and of good quality in lands the drainage of which is defective, and do not suffer in the least from having three or four inches of water at the base during the rainy months; they are also of tolerably rapid growth. Attaining under favourable circumstances a diameter of two feet in ten years, these considerations make them a very desirable tree to plant in waste lands, since little or no levelling or preparation would be needed: on road sides also wherever there are occasional accumulations of water they would grow where no other timber of any value would, and as far as regards ornament, no tree could be more ornamental when in June they become covered with their lilac blossoms. When after being full grown they are cut over they produce in 3 or 4 years a quantity of good coppice wood of much greater durability than seedlings of the same dimensions, and the natives say the oftener this wood is removed the better it becomes. The Red Jarool should be employed as the white is of an inferior quality; this timber attains a large stature and is frequently found of enormous girth; the bark is very astringent. The Ramdallah is very abundant especially on old Jhooms or Kookee clearings, the grain is coarse but handsome and it answers for many sorts of indoor work; its leaves are fed on by a species of tussur silk-worm.

The Phalla is local in its distribution but where it does occur it is in great abundance; it supplies the place here of pine and is considered one of the best plank woods there is, large quantities are floated down the Kata Khal and Borak yearly.

Meliaceæ.

Doopnee Pooma, • Lāōori Pooma, Rokhto Pooma, Aitna Pooma, Jat Pooma, Rohonee Pooma, Bajrang.

An excellent class of timbers for ornamental work, among which the substitute, if not the equal, of Mahogany might probably be found. The Lâoori Pooma springs up in abundance on newly cleared land ; the Rohonee Pooma has when freshly cut a strong and almost unbearable scent of garlic. Bajrang, a thorny thoom weed, has pellucid dots in the leaves which are somewhat thorny and give out when rubbed a smell resembling that of rancid cocoanut oil. The Neem (*Melia azedarach*) exists in the villages, but not as a jungle tree. All the Poomas are very plentiful and general in their distribution ; they prefer uplands.

Cedrelaceæ.

Oofta Pooma, Rangee Ratta, Phoolye Ratta, Boidraj, Bandor Pela.

Oofta Pooma, is the Chickrassoe (*Chickrassia tabularis*) "Chittagong wood." An elegant tree with whitish scaly bark, it has a good reputation but is not sufficiently common to be used for any other purposes than for furniture.

Rangee Ratta, is the *Cedrela Toona* or common toon wood : both it and Phoolye Ratta, (timbers of equal excellence) are common and grow to a very large size. The Boidraj, is common in the Sylhet district, and exists as far down as Dacca, as a cultivated tree ; the timber is of no great repute ; the leaves are fed on in Cachar by the Atlas silkworm. The Bandorpela, produces a timber somewhat resembling Jarool but of inferior durability. During the hot season it attracts attention by its clusters of tempting apple like fruit, from a supposed resemblance of which to the testicles of monkeys the tree derives its name ; the fruit is not eatable.

Citraceæ.

A variety of Citrus grows wild, and is also cultivated in the villages ; it is hardy and a free grower and would probably make good stocks for the orange, the rearing of which from seed is tedious and uncertain.

Spondiaceæ.

Amrah affects low lands and exists wild in great abundance, posts of this tree fixed into the ground will readily strike root, and pieces of it buried their whole length under ground will preserve their vitality for a year and make efforts to send up shoots; but deprived of life, there is no wood that rots sooner, the villagers plant cuttings about their houses; the fruit is eaten by the common red deer (called by the natives Thenga khowra, *i. e.* "eater of acids,") which has a curious habit of forming its seeds into little heaps.

Rhamnaceæ.

Borœ or Baer the common village, sour, round plum: it is not a Jungle tree, though it may occasionally be found in the vicinity of Kooke Jhooms; as may also the village plantain, a thorny crab apple, and the Jack fruit. A wild tussur silkworm feeds on its leaves.

Burseraceæ.

Nagdana, Dood Mohal, Rangeo Mohal.—The Nagdana, is a large erect white barked elegant resinous tree, with rough compound leaves something in the style of the Cedrelads. The resin which is a deep transparent red exudes very freely during the hot months *i. e.* March and April (during which months all the resinous trees bleed most freely), and descends into the ground where large stores are thus formed; long after the tree has disappeared these patches of resin are met with and are dug out, forming the Loban of the bazaar. The ground resin differs from the fresh in being much dirtier and less transparent; after a fire also large masses may be collected in the ground. The wood is of no great repute. The Mohal is among the most abundant trees there are, especially on inundatable lowlands where large patches occur of it alone. The wood has a very bad reputation for durability among the natives, but it would probably, if it were felled at the proper time and some attention paid to seasoning, be found a lasting wood in doors, at least as much so as some varieties of pine; it

has a straight grain, splits readily, and has an inflammable resin; and as it occurs in great numbers, these properties make it one of the most desirable woods for charcoal, its charcoal is very pure, leaving an ash as white as snow. This tree flowers in April at which time the whole Jungle is filled with its fragrance, in August and September the fallen seed germinates and the stalk bearing up the pink seedlobes may be seen everywhere. Every part of the tree has the peculiar scent of the resin which resembles that of "balsam capivi." This is very likely the tree referred to in Hannay's list of Assam trees as *Canarium strictum*, which he had succeeded in identifying as the "Neribee" of China, but his description is not sufficiently minute. The resin of the Mohal instead of acting, as a preservative, hastens the destruction of the timber by attracting borers.

Euphorbiaceæ.

Parie awal, Hindrain awal, Mon awal, Bolos, Juki, Geo koosi, Jhowgra.

The Awals are fine white close grained timbers with greenish heart wood; they approach boxwood in closeness of grain, with this they have a woolly toughness that makes them very difficult to saw. Parie awal which is the best of the class, is reckoned equal in durability to Nagesor, but it can by no means be considered a common wood. The other Awals might be procured in sufficient quantities to make it worth the while of Railway Companies to use them in conjunction with other timbers. The natives prefer ploughshares of Awal to any other as it gets a polish after a time which causes the soil to adhere less to it than to any other wood. The Awals have a trifid leaf sometimes bi and 4 fid with a fringe of leaf on each side of the leaf stalk, which disappears as the leaf gets older.

The Bolos is a large elegant tree, rugged in appearance, and with a dark fissured bark and deep glaucous green foliage; it occurs commonly on new clearings and is fed on by the

Atlas worm: the timber merits no particular notice, being white, soft and wanting in durability.

The Juki is the "Ooriam" of Western Bengal (*Andrachne trifoliata*;) it grows plentifully on lowlands and is of some durability under exposure, it is of a deep red colour and so brittle and short grained as to powder under the plane, it strikes readily from cuttings and is fed on in Cachar by the *Actias Selene* silkworm the moth of which is a sulphur yellow and has tails.

Thowgra is a common clearance weed and has red sap, it is probably the Jugroo of Hanuay's Assam list (*Rottlera peltata*?)

Rosaceæ.

Mon phul, a thorny crab, not occurring as a jungletree but common in the villages where its fruit is cut up dried and strung for consumption, it is probably the Kot korah of Hannay's Assam list, and is fed on in Cachar by the Atlas silkworm.

Fabaceæ.

Kyengla, Engla, Peeplah, Moroe, Koroi, Bharenga, Horreesh, Aowrla, Moorghoo mara, Ooree phooair, Ping, Oshok, Bandor Latec, Kala Honor.

The Kyengla and Engla rank in the very first class of timbers for durability under the most trying conditions; the heart wood of Kyengla is of a deep red colour, close grained, somewhat brittle, but equals if not exceeds Nagessor in durability; it is one of those woods in which there is a distinct demarcation between heart and sap wood the latter being of very inferior durability; unfortunately its scarcity would place it beyond the reach of Railway Companies.

Peeplah, Moroe, Koroi, Bharenga are all *Acacias* with very durable dark heart wood. The Moroe grows on the borders of b'ceels and in swampy places. Horreesh and Aowrla, possess timber of no value, but their bark answers for tanning; the fruit of the latter chewed before drinking water gives the water the impression of being sweet. The

Moorghee mara strikes readily in the form of pole cuttings and is supposed by the natives to be deleterious to fowls, should any of the posts of a fowl house be made of it.

Ping is a timber second to none in abundance and universality, and is most commonly used of any for the posts, rafters &c. of ordinary bungalows and houses; but it would scarcely be worth rafting and conveying to distances as its durability on the ground in the open air does not exceed a couple of years, and it is besides timber of an uncertain quality, parts of a log rotting a year before the rest, it would last well indoor and off the ground but is much disliked by the sawyers. Oshok is the *Jonesia Asoca*, a common middle sized jungle tree which produces clusters of crimson flowers on the trunk in June. Chunduna (*Adenanthera pavonina*) the seeds of which are each one carat in weight, occurs wild.

Anacardiaceæ.

Botöe Am, Luckee Am, Tailo Tailo (sp) Kurrul, Kasi Jawa, Am Jawa, Bowr Jawa.

The Botöe Am answers to the common village mango in its times of flowering and fruiting, and like it the fruit is liable to the depredations of a trunk beetle. The Luckee Am flowers in September and drops its fruit in the February following; the fruit which consists almost entirely of seed is not insect eaten: except by these peculiarities the two trees are indistinguishable to the ordinary eye. The Botöe Am is very abundant and grows to a large size, its timber under exposure is utterly worthless, by being soaked for sometime in water it becomes less liable to the attacks of weevils (gonds) and may then be used in doors for some purposes. The Tailos distinguished by their golden yellow bark and yellow sap, are excellent timbers, of a light red colour, straight grain, and easily workable; they probably answer well for ornamental work, being too limited in quantity for ordinary purposes.

The Kurrul has abundant sap wood which like that of the rest of the trees of this family (except Tailo) is very liable to

dry rot, the heart wood however has no such defect, is excellent, being dark red dense, durable, easily workable though not ornamental; it is one of the straightest splitting woods there is and would probably answer well for shingling. The Kasi and Am Jawa are black varnish trees with leaves differing only in size, the leaves of the Kasi being larger, but both resembling those of the Cashew nut tree; the Kasi is the most venomous of all the Jawas and is that tapped by the Kookees and Munipoorees, as it yields its juice most abundantly. The Am Jawa produces a luxurious looking red striated fruit which is fed on by the red monkey and Hunooman. The Bowr Jawa has leaves $1\frac{1}{2}$ and 2 feet in length, and these being collected in tufts enable the tree at once to be recognized; the fruit resembles that of the Am Jawa but is larger and abounds in acrid juice which partakes of the qualities of paint being unmixable with water, and forming an indelible mark on linen or paper. I have never observed any peculiar effects on the vegetation beneath these trees, beyond what might be fairly attributed to their shade; their timbers rot in a year and are of no value whatever. The Am Jawa with its erect white buttressed stem, and well shaped dark green head, presents a very elegant appearance.

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Quercaceæ.

Ram Kota, Jat Hingra, Ooknee Hingra, Kanta Hingra, Chakhma Ram Kota, a species of oak, is probably in no respect inferior to its English congener; it will last perfectly good under exposure and on the ground for 5 years and upwards, and its durability is increased by charring as is the case with most trees: it is one of the timbers that merits the attention of Railway Companies from its abundance and general distribution; it is not rafted by the natives, since in the present state of the timber trade only such timbers as are easily sawn meet with a ready sale, and consequently Boorha, Ram Kota, Cham and other timbers, which notwithstanding the greater labour of sawing them would be of real value to Railway

Companies owing to their durability, are unsought and neglected, and it is scarcely necessary to say that in this country a supply will never arise antecedently to a persevering demand. In Jat Hingra, another species of oak, there is considerable disparity between the sap and heart wood, the former quickly rot^s while the latter which is of a lightbrown colour is enduring. The Kanta Hingra has its leaves deeply serrated and the new growths resemble red velvet, the acorn, which is with difficulty got at owing to the numerous needle-like thorns with which it is encased, is delicate eating when roasted, the leaves are fed on by a species of *Antheræa*. When this tree does occur it is mostly in groups, the timber makes good planking, but has no great durability out of doors: the other species are of no repute as timbers. Ram Kota produces a large acorn which as it is abundant would probably answer the purposes of valonia.

Urticaceæ.

Sonaputti Chām, Seol Cham, Boga Chām, Dewa Cham, Burr, Roburr, Butt, Dhengoora. The Chams are probably comprized under the name Sām in Assam and Chaplashi in Chittagong, (*Artocarpus Chaplasha*). There are however very different qualities of the timber, the Sonaputti and Seol Cham being the best, and the Kqlabooki Chām (not sent among the specimens) nearly worthless. These two varieties before named are worthy the attention of Railway Companies, from their abundance, general distribution and the large size to which the trees attain. The milky glutinous sap is a great impediment to the saw, and the timber does not become manageable until the sapwood has decayed and been detached, hence the small request in which it is among the native mahajuns; it is however extensively used for dugouts of which I have seen very large ones made out of a single trunk; sleepers made of it would last 5 years and probably longer. In the Dewa Cham the leaves of the young plants and of the stump remaining after the tree has

been cut over are sinuated and become entire, not before the tree attains some height. The Burr is a large smooth leaved tree somewhat resembling when young the Jack tree, its timber is in no request.

Butt, or Banyan, grows wild in Cachar on uplands and alluvium equally; this tree seems incapable of an independent existence and will generally be perceived to have moulded itself on some other tree which it has either killed or is in the course of doing so. The Revd. Mr. Long speaks of the marriage which sometimes takes place between it and the Palmyra, a similar union is sometimes formed here between it and the Burs forming a noble wide spreading tree which attracts to itself ferns and orchids of every variety. In the case of one such tree a distinct cylindrical hollow was left above by the tree on which the two had moulded themselves having perished, the multifid roots of the Butt thrown down along the trunk give the latter sometimes a cross laced appearance; a variety of Tussur feeds on it in Cachar. The *Ficus elastica* is called here both Jiri and Roburr, the latter probably an Anglicism the more readily accepted from the resemblance of the tree to the Burr. A small quantity of India rubber is sent down from Cachar but the trees do not occur in sufficient numbers to make the gathering of the gum a recognized trade.

Some very fine Jack trees occur far out in the jungles inadvertently sown by wood cutters and Kookees. The Dhen-goora bears in the rainy season large quantities of a fruit which is eaten, but is deficient in sweetness.

The Peepul exists as a jungle tree but is much more rarely met with than one would expect from a knowledge of the facility with which it becomes propagated in cultivated districts and the tenacity with which it holds its own in old and ruined buildings. There are in Cachar two stinging nettles, one a tree, with large leaves, which affects low lands, its sting is very painful and enduring and is exacerbated by cold water;

the other a climber with smaller leaves the sting of which is much less virulent.

Aquilariaceæ.

Tuggur.—This is the Hansi of Assam, and produces aloes wood; the timber is straight grained, soft and fissile, out of large trunks dugouts are sometimes made which with care last 2 years; the timber though soft is difficult to saw owing to excessive woolliness.

Lauraceæ.

Kinton, Tej Phooara, Hooara, Cheng Phisol, Gondhrœ.—The first four trees are fed on in Cachar by the wild Mooga silkworm which seems to be identical with the Assam worm (*Antheræa Assamica*). The Hooara is made use of in Assam and in Jynteah for training the cultivated worms on, as also the Cheng Phisol (*Tetranthera lancifolia*) known in Assam as the Soom and given by Masters as a Laurel. The Hooara is rafted down in large quantities for tea boxes, being a very abundant timber, but it has no durability nor indeed have any of the timbers of this class except Sassafras, Gondhrœ, of which the heart wood alone being durable the tree must attain to a large size to be of any use. The young leaves of the Sassafras resemble in odour lemon grass, and make a pleasant tea, when prepared in the same mode as those of the tea plant. The Tej Phooara derives its name from the resemblance of its leaves to those of the Tej Patta or Bag; the latter is extensively cultivated in the Sylhet district, and thrives in Cachar, I have never met with it in a wild state though there is a tree in the Jungles somewhat resembling it, the leaves of which have however a coarser and less pungent flavor.

Sapotaceæ.

Coortah, Hora Coortah.—Trees abounding in milky sap and producing excellent and very durable timber of a red colour, the only defect of which is its liability to crack when exposed to the sun; this is one of the timbers that deserves the attention of Railway Companies, as besides its abundance it is very manage-

able under the saw, it forms a good percentage of the timber at present rafted and could be procured in larger quantities if desired. The sap of one of the Coortals is red : trees of this species frequently occur with a circumference of 3 and 4 cubits and an uninterrupted length of 60 feet, without the slightest bend.

The *Achras sapota* or sapodilla plum is not wild, but thrives as an introduced tree.

Styracæ.

Lodh.*—This tree can be recognized by its straight stem, thick coarse bark and light green foliage, its timber is white, light and answers well for indoor work off the ground ; the leaves are fed on both by the *Attacus Atlas* and *Attacus Canningi* silkworms ; of the fruit stones the Hindus make necklaces (malas.)

Cinchonacæ.

Phakheera, Phakheera, (sp) Huldi Rook, Kadam, Oojah, Matang.

The Phakheeras are small trees with close white timber, thin bark, they resemble in habit the Awals, having like them a tendency to grow screw shaped and whorled. Of two species the leaves possess a powerful and enduring bitter perceived some time after chewing and affecting the fauces ; the bark seems however to be totally destitute of bitter principle. The Huldi Rook (*Morinda bracteata* ?) has a close grained wood, of a fine yellow colour, which also extends to the roots, it is not used for dyeing purposes in Cachar ; the leaves however, particularly the new growths, are intensely bitter and are used by the natives in the sequelæ of fevers ; the tree attains to moderate dimensions and is common both in the jungles and near villages.

The Kadam (*Nauclea kadamba*) affects newly cleared lands, and is of very rapid growth ; in favourable soils (as the uplands) the leaves attain a very large size ; it is fed on by the

* Probably a *Symplocos*. H. C.

Attacus Atlas silkworm and a couple of *Sphinxes*; the timber though straight is of little value.

The Oojah (*Morinda*——?) is also a common plant on newly cleared land, the wood except for door handles has no recognized value, neither has that of the Matang.

Verbenaceæ.

Mhow Heedol, Gamiro, Phool Gamiro, Heol Gamiro, Modhoo-boorha.

Mhow Seedol,* or as the natives with the habit usual amongst them of converting *s* into *h*, call it Mhow Heedol, deserves to be better known than it is; for its excellent qualities in every respect, except that of abundance, it deserves to rank with teak. I have met with logs killed in bygone Kookee cultivation that had been dead twenty years, and yet an inch below the surface were perfectly sound and had lost none of the oil which communicates to the wood its fragrant cedar like scent; the wood works well and is no less ornamental than durable, in short it is without doubt one of our most valuable timber trees, and well deserves the attention of individuals planting out waste lands with timber; if it has not the density of Nagessor and Mahogany, it is of more rapid growth, and is valuable even as a sapling; it requires however good drainage and would therefore be more expensive to cultivate than Jarool, over which it would otherwise be entitled to the preference. The stalks of the new growths are square and channelled and the leaves large and viscous to the feel. The Gamires are excellent and abundant timbers deserving of the attention of Railway Companies, they resist the effects of damp well and are considered to be among the most durable timbers in water. The Heol or Seel Gamire forms siliceous concretions within the wood which sometimes break the edge of the axe.

The Modhoo boorha† is a prettily grained and durable timber, not I believe so well known as it deserves to be. All

* *Gmelina arborea* ?

† *Premna*——?

the timbers of this family are, in short, unexceptionable, and applicable to all purposes whether of use or ornament.

Apocynaceæ.

Carounda (*Carissa Carundas*), which produces the well-known oval acid fruit, is common in a wild state. The timber however is in no repute.

There are other trees deserving of notice but to which we have been unable to assign places ; among these are,—

Goollec,* a crooked tree of small stature, the leaves are velvety to the feel, and the panicles of flowers sweet scented ; the timber of this tree is the nearest approach to box wood there is in Cachar ; the Phakheeras and Awals would also probably make good substitutes for that useful wood.

The Haowra, a sacred tree among the Hindoos, has a curious predilection in its wild state for white anthills, and few of them, especially on upland, have not one and sometimes two of them growing on it. The tree is of medium size and elegant in appearance ; the Munipoorees use the wood for the cross piece of hockey sticks. The Hoondees (Phool, Teel and Sewa) are excellent ornamental woods, when first cut they have the lustre and golden colour of satin wood, but the cut surface quickly assumes a reddish colour. The Kala khoora, known by its black bark, is a durable timber in the ground and on it.

The Mallee comes up thick on Kooke Jhooms and on clearings, the trees stand very close and being of rapid growth soon shade the land, the saplings being very straight, are used for temporary purposes such as building sheds, erecting nursery sheds, their durability is not however great : the bark has considerable tenacity, and is sometimes used as material for rope.

The Toollah is a tree of large stature, the timber of which is used for tea boxes. The Batt Phooair is also a large tree used for a similar purpose.

* *Wrightia* ?

The Badgoor has no great durability but great toughnees, and is used by the natives for ploughshares.

The Koor kooree like the Mallee affects newly cleared lands ; it is fed on by the Atlas silkworm.

The Jinnaree, is an excellent white, ornamental timber, and answers well for door and window frames, the natives use it for oars (bointhas) in preference to any other as it combines lightness with elasticity ; the tree can be known at once by its foliage, the leaves being pendent and having six inches of length to less than one of breadth : it is well deserving of a place in grounds that are being laid out ornamentally.

The Kerca Pooma is a light timber answering well for planking and upper-works.

The Heejol* is a crooked swamp tree, the bark of which is used by the Bengulis for poisoning fish. The Kookees use for this purpose the leaves of a climbing Acacia.

The Koca-magoor the timber of which has a fetid scent, this however does not prevent insects from attacking it.

May 6th, 1864.

Excursion to the Valleys of the Giri, Pabur, and Tonse Rivers.

By H. CLEGHORN, M. D.

On 31st March, 1862, I quitted Simla, accompanied by Captain Houchen, Superintendent of Hill roads, our object being, in accordance with instructions received from His Honor the Lieutenant Governor of the Punjab, to explore the valleys of the Giri, Pabur, and Tonse Rivers, tributaries of the Jumna. The route lay in the first instance by Fagû, and up the valley of the Giri to Kotkai, where there is a great consumption of wood and charcoal in connection with the iron smolting, for which that locality is famous. On our way, we passed in two days fifty mules, and nearly a hundred coolies laden with iron (a mule carries two and a half maunds, and a cooly thirty ~~satta~~), proceeding *vid* Simla to the plains.

* *Barringtonia acutangula*, H. C.

Deodar (*cedrus deodara*) is scarce in this thanna, but there are eight small forests of chil (*Pinus longifolia*), and kail (*p. excelsa*), on Government land, and also a clump of cypress (*cupressus torulosa*), close to the ruined palace. The neighbourhood has been much more wooded formerly than it is at present; this is proved by the increase of the iron manufacture and the innumerable stumps of trees. The forest revenue is almost *nil*, while the destruction of wood is great, and the preparation of the charcoal in open pits is attended with much waste.

The ores are magnetic and micaceous,* the iron is smelted in April and May, after the snow melts, and again in September, October, and November, after the rains cease. During June, July, and August, the manufacture is prevented by the falling of heavy rains. It seems superfluous to give an account of the process, which has been described by others. I may mention, however, that the rude implements employed are not unlike those figured by Col. Yule, in his "Note on the Iron of the Kasia Hills," in Jour. As. Soc. Beng. xi. 857. The aggregate amount exported from Kotkai and Shil, is said to be two thousand maunds per annum.

Pits are dug about six feet in diameter at the top, and three feet at the bottom; these are filled with fresh pine wood, heaped up to three feet above the level of the ground. Fire is applied when the first layer of wood is put in, and continues to burn while the rest is being added. A few spades' full of loose soil are thrown upon the top after the pile has been blazing for sometime; thus, a very large proportion of wood is consumed without being charred, and the charcoal produced is inferior. Efforts were made to instruct the people in this matter, but continued example would be necessary to amend the practice.

The wood chiefly used for charcoal is "kail," but the alder

* See Medicott in memoirs of the Geological Survey of India, vol. iii Pt. 2. p 178.

Woods used for Char-
coal.

“kunch” (*alnus nepalensis*), which fringes the tributary streams is also employed for this purpose. There are no hard woods available.

The zemindars are in the habit of trimming the young pine
Excessive pruning. trees to an injurious extent, to provide

litter for their cattle; often leaving only the leading shoot with a tuft of leaves at the top. We strictly enjoined the people not to head-lop, or otherwise mutilate the trees.

In travelling from Fagû, and again in crossing the Shunkun ridge to reach the valley of the Pabur, the course of the Giri was distinctly seen from its source, where the stream emerges from a wooded chasm; but in looking along its banks, we could not see any large forest, or learn that deodar or other timber had ever been floated down. The Giri is the most western tributary of the Jumna, which it joins in the Dùn, a little below the confluence of the Tonse. In the state of Sirmûr, there may be some timber available near the river, but probably little, as its banks are low, and the district officers do not know of any large forest.

The valley is low, warm, fertile, and dotted with scattered
Valley of Giri. cottages; the mountain slopes are bare.

The principal trees observed in addition to the pines mentioned, were *melia sempervirens*, *pistacia integerrima*, *ficus religiosa*, *putranjiva Roxburghii*, *populus ciliata*, *salix*, *alnus*, *pyrus*, *cerasus puddum*, *xanthoxylon hostile*, and *cotoneaster microphylla*, carpeting the rocks.

The crops are wheat, barleys, several millets, til (*sesamum*
Agricultural produce. *orientale*), tobacco, opium poppy, and various pulses (*vicia*, *ervum* and *phaseolus*). There is no rule for rotation of crops, the hill men sow the same seed in the same ground in successive seasons, and if any villager changes the crop it is from his particular choice.

We ascended the Giri, passing through a kail forest, and
Iron smelting at Shil. crossed the Shunkun ridge to Shil, elevation 7,560 feet, where iron smelting has long

been practised. Here the tools used in making the Hindostan and Thibet road, were manufactured under Capt. D. Briggs' superintendence; and, in connection with this work, a deodar forest was purchased by Government in 1854. This contains many promising young trees. Lord William Hay, late Superintendent of Hill States, frequently visited Kotkai and Shil, and attempted to initiate conservancy rules for the charcoal burning, levying a small rate according to the girth of the trees felled. Charcoal-makers should cut only in such places as are assigned to them in Government forests, and a small payment should be required for the privilege, as is the custom under the native chiefs. All the existing wood will be required for the successful working of the iron mines.

The following shrubs and herbaceous plants occur in crossing the ridge from the Giri to the Pabur.

<i>Hibiscus trionum</i> ,	} in fields.
<i>Hypericum</i> —, ..	...	...
<i>Mirabilis jalapa</i> ,	near villages.
<i>Linaria Elatine</i> ,	} on rocks.
<i>Desmodium tomentosum</i>, ...	...	...
<i>Tussilago petasites</i> ,	} in pasture and glades.
<i>Sibbaldia potentilloides</i>, ...	...	...
<i>Euphrasia officinalis</i>, ...	...	..
<i>Aconitum heterophyllum</i>, ...	...	..
<i>Morina longifolia</i>, ..	...	...
<i>Halenia</i> —, ..	...	...
<i>Thermopsis barbata</i> ,	}
<i>Codonopsis rotundifolia</i>, ...	...	...

Rosa brunonis, .. climbs lofty trees along with *Ampelopsis*.

We descended to the level of the Pabur near Ruru, and Pabur River. traced it to some miles above Shergaon, intending to cross the Changsil range to the Tonse, but the passes not being open, we returned, following the river down to the junction. The main stream emerging from the

Burenda Pass, called by the natives "Bûren ghati," is narrow and rocky, presenting a series of small rapids above Shergaon, which renders the transport of timber impracticable. The declivity of the Pabur between its confluence with the Sipun and Shergaon is 254 feet per mile (Gerard i. p. 232). A few miles lower down floating operations would be extremely difficult. The river after receiving the waters of the Andriti, rising near Shatûl, the Pej, and the Mutriti streams, is more suitable for transporting timber; and with assistance, logs could be sent down during the rains, but a few bamboos or long bullies would be required for pushing off the timbers. There are no falls from Ruru to Raeenghur, but two miles below the fort, large boulders obstruct the bed of the river, and this unfavourable condition exists *passim* down to the junction with the Tonse. In several places a considerable amount of blasting is required to allow the passage of timber, and from the precipitous banks and frequent landslips, it is likely that rocks would occasionally fill up the bed of the stream. The distance from Racenghur to the confluence, is about twenty-six miles, and the average fall of the river is about sixty feet per mile.

The valley* of the Pabur from Raeenghur to Shergaon is wider and more verdant than any other I have seen in the Himalayas; it is beautiful and richly cultivated, but not abundantly wooded. The forests are few, and are chiefly situated on the Changsil range, 2,000 to 2,500 feet above the river bed (left bank). Between Ruru and Shergaon, an extensive forest is seen, occupying two crests behind the ruined fort of Batowli, and two or three miles from the river; it consists chiefly of kail and rai, (*abies Smi-*

* At Ruru the valley is about a mile and at Shergaon half a mile broad. At Ruru our camp was supplied with delicious fish caught in a singular manner not observed elsewhere. Two men stand on the bank of the hill stream, one holding a rod and on the line are fastened a number of goats hair nooses at intervals of a foot, into these the fish are driven by his companion who throws stones into the water as the line comes down to him.

thiana) with small clumps of deodar and oak. The *kelu* (deodar) trees appear to be few and ought to be preserved. On the Pej stream, a considerable forest of moderate sized deodars is seen, three or four miles from the river, which is here difficult for floating. Higher up, towards the Burenda pass* there is a little deodar, but it cannot be made available. In 1861, Mr. E. L. Brandreth, Acting Commissioner, Umballa Division, marched down the whole way from the source of the Pabur, through Choara to Raeenghur, and saw no deodar. At a lower part of its course, there is a fine forest of chil, extending more or less for several miles above its junction with the Tonse, where the river is encumbered with boulders. There is a considerable breadth of river terrace and an easy path way skirts the stream.

Elms and horse chestnuts, walnuts and mulberries, occur near villages. Many of the trees are Timber and Fruit trees. mutilated from the tender branches and young shoots being annually cut off, to be stored as winter fodder for cattle. The dried twigs are lodged in the fork of the denuded trees, and secured with grass ropes; whence when pasture is scarce, a bundle is taken as required. *Pistacia integerrima*, "kakkar," is frequent on the river bank below Raeenghur, many trees were seen which would yield planks 6 to 8 feet long by $1\frac{1}{2}$ to 2 feet broad. Apricots, peaches, and plums abound in this beautiful glen. The Himalayan alder (*alnus nepalensis*), is a very large and straight tree, fringing the river banks above the junction of the Tonse. In addition to these, *berberis lycium*, *prinsepia utilis*, (*bekul*), and *eleagnus conferta* (*gehai*), are economic plants, useful in various ways.

* Vide Capt. Alexander Gerard and John Gerard's Journey to the Burenda Pass. vol. i 1840, also "Jacquemont Voyage dans l'Inde." tom. 2 p. 431 and "Journal of a trip to the Burenda pass in 1836, by Lt. T. Hutton in Jour. As. Soc. Beng. Nov 1837.

Excursion to the Shatool and Buren Passes over the Himalaya, in September, 1845. By Capt. Madden, Bengal Artillery. Jour. As. Soc. Beng. 1846.

Broad river terraces from four hundred yards to a quarter Agricultural produce. of a mile in width are devoted to rice cultivation, for which this valley is celebrated, and through these the traveller's path lies. In spring, the opium poppy is largely cultivated, but in small patches; at the date of our visit, the plants were several inches above ground; the capsules are small, the lancet for making the incision resembles that used in the plains. Tobacco, sesamum, and vetches, including *erum hirsutum* "masur," are grown in small quantity. In warm situations, barley is sown in March; wheat and several millets are likewise extensively cultivated.

There was great abundance of wild mustard (*sinapis*) used for the purpose of obtaining oil. The poppy and tobacco ground is frequently weeded, and is kept clean. Previous to its being ploughed by the men, cattle manure is carried out in* kiltas by the women upon whom all the drudgery devolves. The articles of export from the valley are wheat, barley, rice, tobacco, opium, tar, kelu oil, apricot oil, ginger, hides, iron, wool, potatoes, honey and wax.

Above Shergaon, towards the Burenda pass, the food of the people consists chiefly of buckwheat (phapar) *fagopyrum esculentum*; the red amaranth (bhatu),† and the smaller millets (chini and koda), *panicum miliaceum* and *paspalum scrobiculatum* with mandua, *eleusine coracana*. In Sept. and Oct. this amaranth gives rich tints of carmine, orange and yellow to the land-scape while the buck-wheat assumes a delicate pink.

The Touse (*tumasa* or dark), so called from its being skirted in the upper part with gloomy forests, is larger than the Pabur (i. e. clear) river. They unite at Tuni, and fall into the Jumna in the Dûn, a little above the confluence of the

* Long deep baskets.

† Une espèce d'amaranthus appelée *bhatu*, et dont les feuilles servent d'aliment aux montagnards pendant la saison des pluies, est plus généralement cultivée sur les pentes; elle forme maintenant de magnifiques tâches cramoisies sur le tapis de verdure qui les recouvre. *Jacq's Voy* : t. ii. p. 484.

Giri. I ascended the river for two stages above the junction, and followed its course downwards for twenty miles below the Tuni bridge. Five miles above Onowli, the limit of my observations, the river is from fifty to sixty feet in breadth, and it scarcely fordable, even at this the lowest season. I searched for an easy ford among the broad reaches of the river, but without success. The water was four feet deep, and the current strong; the temperature at 4 P.M. was 42°. The bed of the river is stony, but the boulders are not large, and the absence of sand and soil in the channel is remarkable—the strength of the current washes all down, and leaves the boulders clean. In July, August, and September, the river is in flood, and of such a volume as to float timber of moderate length. At several angles, about two hundred logs in the aggregate of last year's cutting, were seen stranded, some of them ten feet above the present water mark. The banks further up the river towards* Kedarkanta, are densely wooded; that mountain is distinctly seen from Onowli, at no great distance, towering to a great height (12,680 feet). Above the junction of the parent streams Rupin and Supin, the river is unfit for floating purposes.

The elevation of the rope suspension bridge or *chuk-zam* at† Tuni is nearly 3,000 feet above the sea. The river bed below the bridge is stony and tortuous, but there are no very large boulders, and comparatively few logs appear to have been stranded out of five thousand, which by report were sent down last flood. I followed the Massouri road down to Bandrowli, where the Tonse turns south-west, and receives the Shalla, and Suinj streams, considerable feeders, rising in the valleys of the Chor mountain. It did not appear necessary to proceed further, as the deodar forests do not extend lower, the whole flora is characteristic of the outer Himalaya and the enlarged river is more suitable for transport.

* See view of Kedarkanta and deodar forest in Jacquemont's *Atlas*, pl. 31.

† 2,850 feet in *Jour. As. Soc. Beng.* Novr. 1837. p. 938.

Above the junction of the Pabur near the villages of Man-Valley of Touse. drat and Onowli, the valley is of considerable breadth; the path runs along the left bank, from which the mountainous ascent is more gentle than on the right bank. The higher slopes 2,500 to 3,000 feet above the river bed, are everywhere crowned with forests of pine (kail, rai, and deodar). In the hot valley for some miles above the bridge there is a forest of tall straight chil, (called *sulli* in Garhwal), which lies convenient for transport on the lower slopes of the hills. The deodar is seen feathering the highest ridges, but not within two koss of the river until reaching Naintwar, the junction of the Rupin and Supin: here it grows near the stream, and trees have been lately felled, but the logs were much injured by being hurled over precipices.

There is a large quantity of deodar near Bastil, within a radius of six miles from the bridge but it is not easily accessible to the river. The possibility of fetching it has been proved, as twelve very fine logs, averaging fifty-five feet in length, were brought down to renew the sangla wooden bridge under the orders of Lord William Hay. The expense of transport, however, was very great, and the river, from its sinuosities, does not admit of floating timber of large size. If the trees were divided into sleeper lengths or short logs (say 12 feet), they would float more safely, and be carried down at less cost and risk.

Sissoo (*dalbergia sissoo*), is in considerable quantity, and Hard woods. skirts the river bank below the junction; however, it is generally small and crooked. By diligent search, a considerable number of trees yielding sleeper dimensions may be found. It serves well for this purpose and for the manufacture of railway carriages. Toon (*cedrela toona*), and kakkar (*Pistacia integerrima*) are found sparingly on the river bank below the rope bridge but the best trees have been removed.

Olive (*olea europaea*) This tree distinguished by its leaves,

which are rust coloured below, is found abundantly on the bare rocks about Tuni. It is much valued in the district, and is often naturally conserved by the inaccessible position of the trees. The unbranched trunk is rarely more than ten to fifteen feet high, and the wood is seldom sound throughout; it is prized for making the "tangili" or forked stick used by the men who prepare the rope bridges.

The village orchards consist chiefly of apricot, peach and Fruits. walnut trees, all yielding fruit abundantly, which is stored with care for winter's consumption. The people spread out vast quantities on the house tops to dry. The bears which are very numerous, visit the orchards at night and devour the fallen fruit. Dried apricots are sometimes packed in kid-skins, as dates are in Egypt, and in like manner are used as pilgrim's food.

The apricot cultivated so largely in Himalayan valleys is a very hardy small leaved tree, often with a spreading habit. It is characteristic of cultivated spots up to 11,000 ft. The fruit is small and firm fleshed, very different from the melting sorts of an English orchard house; it dries well, and is a valuable article of food. The crops of fruit obtained in Kullu are very large, Jacquemont remarks as follows "Sa fécondité est extrême; partout les branches plient sous le faix des fruits dont elles sont chargées. Ils sont d'ailleurs fort petits et assez insipides, ils ne sauraient avoir beaucoup de parfum. C'est, à cette époque d'année une partie importante de la nourriture des montagnards. On casse leurs noyaux pour extraire des amandes une huile qui sert à bruler." *Journal*. t. ii. p. 108.

Walnut trees are in great abundance; the price of the fresh walnuts is one rupee per thousand, and of apricot oil one rupee for six seers, but it is not made in large quantity. *Picus oaricoides* "tirmul" yields an edible fruit. Mulberries are planted in the lower valley; the *rottlera* and gigantic *bombax* show the sub-tropical character of the vegetation, the rain fall being moderate.

The agricultural produce consists of rice, barley, poppy, Agricultural produce. and tobacco, with the usual millets, and in one damp spot *coix lachryma* (Jobs' Tears), was found. In one or two places a grassy plateau was seen affording good pasturage.

Deodar wood exists in large quantity in native Garhwal, near Timber. the junction of the Rupin and Supin, and a variety of other useful timbers, oak, elm, chil, kail, etc. The mountain slopes are very steep, and the river Tonse flows impotuously through a rocky chasm, but during flood it contains sufficient water to carry heavy timber. The rush of the torrent would probably erase any ordinary marks, and confusion would ensue if many were to engage in the trade. Wood-cutters are procurable in the valley of Tonse for five rupees per mensem, and mates for eight.

The Pabur and Giri rivers flow through the principalities of Bussahir and Sirmur respectively, the supply of Deodar is scanty in the upper valleys and the volume of water is too small for floating logs. In the lower part of their course, *chil* and other woods can be obtained in small quantity and short lengths. It may be mentioned that Dr. Brandis, who travelled up the valley of the Tonse, as far as Bandrowli, states that the deodar trees in the forests of British Garhwal are generally not large, seldom exceeding 8' in girth and 110' high, but that he found one 17' in girth and 150' high. The trees in Bussahir and Chamba are often of much larger dimensions.

Notes on the Vegetation of the Sutlej Valley. By

H. CLEGHORN, M. D.

From the Giri, Pabur and Tonse, tributaries of the Jumna, I proceeded to explore the wooded tracts of Bussahir. The report of the journey has been published, in the Records of the Punjab Government, but as my diary contains particulars perhaps not devoid of interest to the general reader, I now

offer to the Agri-Horticultural Society some extracts with additional notes upon the vegetation of the Sutlej valley, in which I spent part of April and May 1862.

The following notice of the flora of Simla district is given in Hooker and Thomson's *Flora Indica*, p. 203.

"The flora of Simla may be considered as exceedingly well-known; it presents a considerable proportion of Eastern Himalayan plants that do not appear to cross the Sutlej basin, and a smaller one proportionally of Western species not found in Garhwal.

WESTERN SPECIES.

Thalictrum pedunculatum. *Adonis æstivalis.*

EASTERN SPECIES.

<i>Clematis nutans.</i>	<i>Antidesma paniculatum.</i>
<i>Thalictrum rostellatum.</i>	<i>Betula cylindrostachya.</i>
<i>Ranunculus diffusus.</i>	<i>Alnus Nipalensis.</i>
<i>Delphinium vestitum.</i>	<i>Myrica sapida.</i>
<i>Spheroostemma grandiflorum.</i>	<i>Cupressus torulosa.</i> †
<i>Stephania rotunda.</i>	<i>Potentilla fulgens.</i>
<i>Holboellia latifolia.</i>	———— <i>leucomotha.</i>
<i>Dicentra Roylei.</i>	———— <i>Kleiniana.</i>
<i>Benthamia fragifera.</i>	<i>Sibbaldia potentilloides.</i>
<i>Daphne papyracea.</i>	<i>Sieversia elata.</i> ‡
<i>Osyris arborea.</i>	<i>Cerasus Puddum.</i> ¶

In the tropical valley of the Sutlej the vegetation resembles that of the outer hills, and dry country forms predominate, as *Colebrookia*, *Rottlera*, and *Euphorbia pentagona*; whilst *Bambos*, *Butea*, *Agle Marmelos*, *Moringa pterygosperma*, *Capparis sepriaria*, and *Calotropis*, seem altogether absent, or are very rare."

The forest on Mount Jako chiefly consists of *Cedrus deodara*, *Pinus excelsa*, and *Quercus incana*, with *Euonymus*, *Rho-*

* Found in Suraj between Sutlej and Beas. † Abundant on Rotang Pass.

‡ A clump at the junction of Budhil and Ravi. ¶ In Kulu — H. C.

dodendron arboreum, *Ilex dipyrrena*, &c. The north slope of the Mahasu ridge is covered with "mohru" (*Q. dilatata*) and towards Fagu there are the remains of a fine forest of doodar, mingled with rai (*Abies Smithiana*), kharsu (*Q. semicarpifolia*) *Acer*, *Pavia*, *Benthamia*, *Euonymus*, *Juglans*, and *Pyrus*. The forest is always more dense on the northern face.

In the ravines within two hours walk of Simla, the following shrubs are found amongst others; *Deutzia*, *Viburnum*, *Lycasteria*, *Limonia*, *Prinsepia*, *Spiræa*, *Eleagnus*, *Buddlea*, *Lonicera*, *Rubus* and *Rosa*.

The most common herbaceous plants in the woods are:—

<i>Anemone vitifolia.</i>	<i>Valeriana.</i>
——— <i>obtusifolia.</i>	<i>Ophiopogon intermedium.</i>
——— <i>polyanthus.</i>	<i>Arisæma Jacquemontii.</i>
<i>Delphinium incanum.</i>	<i>Urtica heterophylla.</i>
<i>Aquilegia vulgaris.</i>	<i>Impatiens.</i> (several sp.)
<i>Thalictrum foliolosum.</i>	<i>Scutellaria.</i>
——— <i>pedunculatum.</i>	<i>Primula.</i>
——— <i>rostellatum.</i>	<i>Epilobium laxum.</i>
<i>Clematis montana.</i>	<i>Gernium.</i>
——— <i>grata.</i>	<i>Potentilla.</i>
<i>Rubia cordifolia.</i>	<i>Viola serpens.</i>
<i>Galium Aparine.</i>	<i>Fragaria vesca.</i>
<i>Begonia.</i>	<i>Parnassia multica.</i>
<i>Saxifraga ciliata.</i>	<i>Cypripedium cordigerum.</i>
<i>Ruta albiflora.</i>	<i>Cyrtopera flava</i> —rare.
<i>Galatilla juncea.</i>	

On the naked ridges are:—

<i>Gnaphalium</i> 3 sp.	<i>Thymus serpyllum.</i>
<i>Androsace sarmentosa.</i>	<i>Berberis.</i>
<i>Onoseris lanuginosa.</i>	<i>Linaria.</i>

Amongst naturalized plants may be noticed:—

<i>Melanthus major.</i>	<i>Clarkia.</i>
<i>Mirabilis jalapa.</i>	<i>Capsella bursa pastoris.</i>
<i>Hibiscus Syriacus.</i>	<i>Gaillardia.</i>

Much reliable information concerning the climate and productions of the Sutlej valley, is contained in Gerard's *Kunawar*, 1833, with Capt. J. D. Cunningham's *Notes in the Jour. As. Soc. Beng.* xiiith (1844); in Jacquemont's "*Voyage dans l' Inde*," 1844; in Thomson's *Travels*, 1852; Cunningham's *Ladak*, 1854; and in various papers of Major Madden, Capt. Hutton, and Mr. W. Theobald, jun, in the *Jour. As. Soc. Beng.*

The Right Honourable the Governor General of India the late Lord Dalhousie, planned and commenced during his administration, this imperial line of traffic from Hindostan to Central Asia, from which, even in an unfinished state, great benefits undoubtedly have arisen. The road was commenced in 1850, under the superintendence of Major Kennedy, and afterwards of Capt. D. Briggs. The original idea was, that the road should be available for wheeled carriages through its entire length; this plan has now been abandoned, and a good road for laden mules is in progress to the Chinese boundary. A branch road has been made from Kotgur to Serahan, *via* Rampur, the capital of Bussahir, and the principal resort of traders from the north as well as the south.

Kotgur, four marches from Simla, was the residence of the brothers Gerard, they surveyed the whole valley in 1815-21, and Capt. A. Gerard has described it in his "*Account of Kunawar*." In the neighbourhood of Kotgur, the deodar existed at one time in considerable quantity, but did not attain a very large size. The valley is richly cultivated, and dotted with numerous villages; rice is grown below; barley and red amaranth above. Kotgur is a station of the Church Missionary Society. There is a flourishing tea plantation belonging to Mr. S. Berkeley, who has introduced many European fruits and vegetables into his garden. As the road to Kullu passes Kotgur, a considerable number of travellers

* Including vines, pears, gooseberries, currants, &c.

visit this small station. A daily post connects it with Simla, and there is a resident thannadar.

The following is Capt. Gerard's table of the mean temperature in-doors at Kotgur in 1819-20.

January, 39°. Fahr.	July, 69°. Fahr.
February, 43°.	August, 69°.
March, 51°.	September, 66°.
April, 57 .	October, 59°.
May, 63°.	November, 48°.
June, 69°.	December, 45°.

The breadth of the Suttle at Wangtu is about ninety feet: Wangtu bridge the height of its bed, as determined by Gerard, 5200 feet. The remarkable wooden* bridge which here spans the river is the finest specimen of the kind I have seen. The square towers on either bank are about fifty years old, and existed before the bridge was destroyed, during the Gurkha invasion (Gerard, p. 37); the beams laid across were renewed in 1859; the falling of the bridge in that year threw back a great part of the traffic into other channels. The permanence of this crossing is of vital consequence to the trade with Central Asia, and the pushmt† traders and grain merchants, whom we met coming down the valley, enquired earnestly as to the state of "Oangtu," which was the only bridge in Kunawar by which laden sheep and mules could cross the Suttle. Since my visit a substantial new sango has been built under the superintendence of Capt. A. M. Lang, R. E.

Jhulas or rope bridges exist at Rampur, above Serahan, Rope bridges opposite Miru, and at Poxree, but whether swinging or suspension bridges, they are equally unsuited for the passage of sheep and mules, and the want of bridges is much felt.

With road extension and forest operations in prospect, Want of Medical aid. the sanction by government of medical

* See Jacquemont's drawing of this bridge, *Atlas*. pl. 32.

† The fine wool of which shawls are made.

aid is an important consideration. Throughout Bussahir, the hill villagers gather round the traveller imploring medicine; their faith in the skill of European physicians, and in the efficacy of our drugs is remarkable and embarrassing. My professional knowledge was called into play in answering endless applications for medicine.

In Bussahir, the inhabitants suffer from goitre, but not Diseases of Kunawar. so much as in the valleys of the Pabur and Tonse; the general impression is, that the disease arises from drinking snow water, but this is erroneous, as the people in the higher valleys do not suffer so much as those in low situations.* In upper Kunawar fevers are rare while in the lower part of the Sutlej valley they are not uncommon. There is a very large amount of ophthalmic disease; the eyes become inflamed by the reflection from the snow, and are further injured by rubbing with dirty woollen cloths. Rhubarb leaves and hair spectacles are used in summer to protect the eyes in crossing the passes. Travellers ought to be provided with gauze veils or neutral tint glasses for the eyes. Fresh butter which may be made in a bottle, should be applied to the eyelids when suffering from snow blindness. The other prevalent ailments are catarrh, rheumatism and syphilis.

The peculiar advantages of Chini, in possessing a dry climate of Caimi. ^{climate} and congenial temperature, are very remarkable. The notes of Dr. A. Grant, Physician to the Marquis of Dalhousie, which appeared in the *Annals of Medical Science*, No 1. 1854, contain the best account of the climate and advantages of this retreat,† where the Governor

* Dr. Hooker makes the following ingenious suggestion. "May not the use of the head-strap be a predisposing cause of goitre, by inducing congestion of the Laryngeal vessels?" I do not think this can be the cause, as in Bussahir it is the universal practice to use shoulder straps and very rarely head-straps, and the disease is not uncommon among Hill Chiefs whose cervical muscles have never supported a load of any kind.

† See also Benares Magazine Vol. 8. p. 988.

General resided during the hot weather* and rains of 1850. A summary of Dr. Grant's observations will be found in the Report of the Sanitary Establishments for European Troops in India, No 1. p. 73. (Calcutta 1861.)

In Kunawar, few village lands produce more grain than Food. the inhabitants require, and food is annually imported into the district. Grain is brought from Garhwal on the east, and supplies must be carried up from Rampur or Simla by all visitors. The people do not part willingly with their attá, even at eight seers per rupee, the present rate at Chini,* and during my tour provisions were brought from a great distance. In times of scarcity, the people eat Himalayan chestnuts, *pavia indica*, and apricot kernels; they soak them to remove the bitterness; and grind the whole into flour with the inferior millets, forming large chupatties. It is desirable to supply seed, and to encourage the growth of esculents in these valleys, where so great a demand has arisen from the influx of summer visitors; for this purpose, the Agri-Horticultural Society of the Punjab annually grants a liberal supply of vegetable seeds for distribution among the inhabitants. In upper Kunawar, the inhabitants depend much upon the cultivation of vineyards and orchards and like the Lahoulees are carriers of produce.

Agriculture is capable of little extension, from the precipitous character of the hills, and the small proportion of arable land. All the available ground is laid out in terraces, and the cultivation is carried on with great care; the soil is good, and the small fields are enclosed with loose stone dykes. As soon as the snow melts, ploughing commences, and the women are sent out with baskets of manure.

Every cultivator heaps up before his door or under his house the dung of all the sheep and cattle, and mixes these with the dry grass and leaves used for littering the animals.

* It used to be thirty or forty seers per rupee, vide Gerard, 1820. Capt. J. D. Cunningham purchased wheat flour at ten seers per rupee, 1844.

Oak, pine and rhododendron leaves are most used. To this are added the dried capsules of poppies and shells of walnuts, with refuse chaff (bhōosa) when not required as fodder. Indeed this branch of rural economy is well attended to and these substances having lain during the winter months are found to be well mixed and rotted in spring when they are applied to the soil, both at the time of sowing and after the plants appear above ground.

The *Rubbee* or Spring crop.

Wheat,	}	require the best soils, and are manured.
Barley,		
Tobacco,		
Opium,		
Masur,		

Ervum hirsutum.

The *Kharif* or autumn crop.

Mandua,	<i>Eleusine coracana.</i>	
Rice,	<i>Oryza sativa.</i>	(not in Kunawar)
Kulth,	<i>Dolichos uniflorus.</i>	
Batu,	<i>Anaranthus frumentaceus.</i>	
Kuchalu,	<i>Colocasia antiquorum.</i>	
Kungni,	<i>Panicum italicum.</i>	} in both harvests.
China,	<i>Panicum miliaceum.</i>	
Sanwuk,	<i>Panicum frumentaceum.</i>	
Mukki,	<i>Zea mays.</i>	
Koda,	<i>Paspalum scrobiculatum.</i>	
Paphra,	<i>Fagopyrum esculentum.</i>	
Oagul,	<i>Fagopyrum emarginatum.</i>	
Bharat,	<i>Soja hispida.</i>	
Moong,	<i>Phaseolus mungo.</i>	

The fleshy and stone fruits of Kunawar* are the grape, Cultivated fruits. apricot, peach, apple, walnut, and mulberry ;

* Jacquemont II. p. 302 "Les deux espèces de cerisier nain (*Cerasus miniatas*) &c. de Kunawar abondent autour de Dablung. Leurs fruits, que j'y goûtai pour la première fois parfaitement mûrs, ont le goût agréable et rafraîchissant des meilleures cerises." The pergunna of Pangl in the valley of the Chenab is the only place where I met with cherries of good flavor.—H. C.

Sungnam is famous for its apples; Akpa for grapes; and Pangri for walnuts. With the abundance of fruit, the beautiful scenery, the delightful and salubrious climate, and the fact that Chini is on the high road to Central Asia, nature renders it one of the most attractive spots in the Indian Empire. Hopsets planted in the upper valley near Kanam have fruited well.

Many European and American vegetables have been introduced and grow well; the potato is

Potato culture. found to thrive remarkably, though the inhabitants of the upper valley do not yet cultivate it to any extent. For several stages from Simla the increased cultivation of this esculent is very surprising and it is largely exported to the plains of the Eastern Punjab. The soil on which it is grown is generally loose and stony, the steepest slopes seem to be preferred on account of drainage. The system pursued is this:—the underwood is first cleared and burned, then the deodar trees are removed or thinned out, and the spruce fir (*Abies Smithiana*) killed by barking, the trunks falling in the course of a year or two. The kharsu oaks often alone remain for shade, and they are gradually felled for charcoal. On the steep slopes where the dense forest has been removed, several landslips have taken place. After manure has been supplied to the soil the potatoes are planted in the middle of April or May, upon narrow terraces, and before the rains commence the ridges are hoed up to cover the tubers. The subsequent growth both of stems and root is most luxuriant. At the close of the rains five months after planting, the tubers are dug up, fully ripe. They are packed tightly in woollen bags and despatched generally on mules to the plains. These are relieved of their burden twice a day, when the sacks are thrown down carelessly at halting places which bruises the potatoes; the plan of packing them in boxes might secure more careful transport. The contemplated widening of the road from Simla to Nagkanda for cart traffic would be of great

* The price on the field at Fagu is 2 Rs. per maund of 80 lbs.

importance as the sacks once placed in the cart would not require to be removed till it reached Kalka or the railway.

Turnips are sown after the cereals have been reaped, they are eaten fresh or stored for winter use. In crossing to the Asrang valley my guide carried no food except 4 or 5 half dried turnips not much larger than a billiard ball.

In addition to the pines, see list, there are three species of oak which are next in importance. Vast forests of them occur in various places, as upon the east side of Hattu, on the upper track between Mattiana and Nagkanda, in Mandi, and Sukhet. The trees are of great size, 80 to 100 feet in height, they prefer dry situations, and are not generally convenient to the river. The logs do not float the first and second years, being in this respect like the black wood of Malabar. Oak wood has been well reported of by General Cautley, at Marri; Mr. Smithe, Superintendent Workshop, Madhopur; and by Dr. Campbell, of Darjeeling.* When the cart road to Nagkanda is opened out, fine straight logs of oak may be brought into Simla. If approved by the railway officers, this timber might be supplied from the Hill States, and launched below Kotgur, supported by bamboos, or lashed to pine logs. Several species of oak are much used for railway sleepers in North America, and there can be little doubt, from their great density, that two of the Himalayan oaks are useful timbers. In colour and grain the *mohru* resembles the British oak.

There is abundance of yew and olive, and a considerable quantity of box and ash in the valley of the Sutlej. The ash, box and olive occur near the river, the yew prefers the higher slopes, and is generally 2,000 feet or more above the bed of the Sutlej. The ash and yew are much esteemed for jampan poles, tool handles, &c. The former in colour, grain, and toughness resembles the English ash. The

box and olive being hard and close grained, might be useful to the Railway company for wedges and trenails.

These are the principal timbers of Bussahir, which from their abundance and varied qualities, are valuable for engineering purposes. There are others, as maple, elm, walnut, plane, and alder trees, found in smaller quantity.

In upper Kunawar the vine is extensively cultivated
Vine culture. and ripens its crop at an elevation of from 6—9000 ft. The first plants are seen at Nachar, but the climate there is not suitable; beyond the Miru ridge which intercepts the heavy clouds, the smaller amount of rain favors the ripening of the grapes. The vineyards occupy sheltered situations generally on the steep slope facing the river. The vines are supported on poles three or four feet from the ground connected by horizontal ones. The fruit hangs below the shade of the leaves, never exposed to the sun. A considerable portion of the crop is dried on the housetop and stored as raisins for winter use, but without care, and many grapes are spoiled in the process. For several years the crop has been deficient, the grapes dropping off before they were ripe from unseasonable falls of rain and snow. This year, 1864, the rain fall was moderate, but the *Oidion* or vine disease appeared in the valley, and destroyed many vineyards. The fresh fruit is exported to Simla for sale in *kiltas* or large hill baskets, and the small seedless grapes dried are also sold there as "fine Zante currants," at 2 rupees per pound. At Akpa and Poari the price of fresh grapes is about one rupee for a *kilta*-full. "Sungnam is the highest point in the valley where the vine thrives." (*Jacquemont's letters* p. 266.)

An admirable description of the configuration of the hills, and of the Useful plants of Kunawar. botanical features of the valley of the Sutlej is contained in Thomson's "Travels in the western Himalaya." In determining the native names of the plants of Bussahir, much assistance may be derived from consulting the copious Index of Royle's "Illustrations of the Botany of the Himalaya," and Janssen's "Report of the Botanical Gardens, North West Provinces, 1846." The following list is a tolerably complete summary of the useful plants between Rampur and Sungnam, which travellers along the Hindostan and Thibet road may expect to find.

Principal Plants of the Sutlej Valley, with Native Names and Approximate Elevation.

TIMBER TREES.

Hill Name.	Botanical Name.	English.	Elevation.	REMARKS.
Kelu or Kel- mung, ...	<i>Cedrus deodara</i> , ...	Deodar or Him. Cedar, ...	6000-10,000, ...	Properly <i>deara-daru</i> , god-timber, probably identical with the cedar of Lebanon.
Kail or Lim, ...	<i>Pinus excelsa</i> , ...	Lofly pine, ...	7000-12,000, ...	The wood being very resinous it is used for torches which give a beautiful light.
Chul or Sulla, ...	<i>Pinus longifolia</i> , ...	Fir, long leaved, ...	1500-6000, ...	The resin is used as a dressing for sores.
Nees or Ri, ...	<i>Pinus gerardiana</i> , ...	Edible pine, ...	5000-10,500, ...	Wood not used.
Kai or Ryung, ...	<i>Abies smithiana</i> , ...	Him. Spruce, ...	9000-11,000, ...	} The wood of these is much inferior to the other pines.
Pindrow or Tos, ...	<i>Picea webbiana</i> , ...	Webbian pine or ...	8000-12,000, ...	
Deodar, ...	<i>Cupressus torulosa</i> , ...	Silver Fir, ...	8000-8000, ...	} Wood useful, but trees scarce, not felled.
Lewar or Shur, ...	<i>Juniperus excelsa</i> , ...	Cypress, ...	9000-12,000, ...	
Pama or Talu, ...	<i>Juniperus squamata</i> , ...	Pencil Cedar, ...	12,000-13,000	Yields an excellent, light, odoriferous wood.
Tuna, ...	<i>Taxus baccata</i> , ...	Creeping juniper, Yew, ...	9000-10,500, ...	Used as firewood in crossing the high passes.
Paprang or Sham- shad, ...	<i>Buxus sempervirens</i> , ...	Box, ...	6000, ...	Plugs of this wood were used in the new Wangtu bridge as abutting pieces for ends of struts and braces. Wood good for bows and jampan poles. The inner bark used as a substitute for tea.
Ban, ...	<i>Quercus inozana</i> , ...	Hoary oak, ...	5000-8000, ...	Wood used for plugs of rifle bullets, also for wood engraving.
Bré, ...	<i>Quercus ilex</i> , ...	Evergreen oak, ...	6000-8000, ...	The principal firewood in the hill stations. Mirn and Chegaon.

* For an excellent account of the Himalayan conifers, see Major Maclean's papers in the 6th and 7th vols of this Journal, and in the Transactions of the Botanical Society of Edinburgh. Tar is obtained by heating chips of kail, kail and chil, the method of native manufacture with sectional view of the still is given in *Jour. As. Soc. Beng.* vol. ii. 249, and in Selections from the Records of Punjab Govt. vol. ii. 249.

Hill Name.	Botanical Name.	English.	Elevation	REMARKS.
Mohru,	<i>Q. dilatata</i> , ..		6000-9000, ..	<i>Q. floribunda</i> , Wall. Yields an excellent heavy wood.
Kharan,	<i>Q. semecarpifolia</i> , ..	Alpine oak, ..	9000-12,000 ..	A magnificent tree, timber much esteemed by the natives.
Pahari Pipul,	<i>Populus ciliata</i> , ..	Poplar, ..	6000, ..	Wood soft, coma of seeds a paper stuff.
Akrot,	— <i>alba</i> , ..	White poplar, ..	9000, ..	Common at Pangi and Sungnam.
Kunch,	<i>Juglans regia</i> , ..	Walnut, ..	7000-9000, ..	Wood used for gun stocks and furniture
Knor, ..	<i>Alnus nipalensis</i> , ..	Alder, ..	4000-5000, ..	The charcoal employed in iron smelting.
	<i>Pavia indica</i> , ..	Him. horse-chest-nut, ..	5000-8000, ..	Seeds eaten in time of scarcity.
Bras, ..	<i>Rhododendron arboreum</i> , ..	Rhododendron, ..	6700-8000; ..	Flowers made into jelly, sub-acid.
Bhoj-putra,	<i>Betula bhoj-putra</i> , ..	Birch, ..	10,000-13,000	Bark for writing on, and covering umbrellas.
Shko, ..	<i>Ulmus erosa</i> , ..	Large leaved Elm	6000-9000, ..	Wood more open-grained than English elm.
Maldung,	— <i>virgata</i> , ..	Hazel, ..	9000, ..	
Bankmu,	<i>Corylus laevis</i> , ..	Polished maple,	8000, ..	Wood light, compact.
£	<i>Acer laevigatum</i> , ..		9000, ..	The knots are hollowed out, and used as drinking cups.
	— <i>sterculiaceum</i> , ..			
Kahá or Wí,	<i>Olea ferruginea</i> , ..	Olive,* ..	3500-5000, ..	Wood used for combs, it is much like box.
Cham Kharak,	<i>Carpinus viminea</i> , ..	Hornbeam, ..	5500, ..	Wood esteemed by carpenters.
Eliyun or Ayar,	<i>Anaromeda ovalifolia</i> , ..	Andromeda, ..	7000, ..	Wood used for charcoal.
Rous, ..	<i>Cotoneaster bacillaris</i> , ..	Him. mountain ash, ..	8000-10,000, ..	Wood used for walking sticks.
Thurnel,	<i>Benthamia fragifera</i> , ..		6000, ..	The fruit used as a preserve.
Behul,	<i>Grewia oppositifolia</i> , ..		5000, ..	The twigs are periodically cut in winter time as provender for the cattle. A common sort of rope is made from the bark for local use.
Dhamun,	— <i>elastica</i> , ..		4000, ..	

Hill Name.	Botanical Name.	English.	Elevation.	REMARKS.
Angur,	<i>R. groenlandica</i> , <i>Vitis vinifera</i> ,	Gooseberry,* Vine, ..	10,000, 7000-9000, ..	Astrung valley. The grape is an uncertain crop, and an excess of rain is particularly unfavourable. The neoca or chilgoza pine, is first seen on the Miru ridge, and above Chini becomes a principal tree of the forest. The seeds are collected and stored for winter use, being a regular article of food—the price asked in spring was two annas per seer. The nuts are sold in Simla. Fruit used for making sherbet. Fruit used for preserves. Common, but produces a small tasteless fruit. Cultivated, foliage prized for cattle. Found in all the high valleys.
Ré or Neoca,	<i>Pinus Gerardiana</i> , ..	Edible pine, ..	7000-10,000, ..	
Fenduk, Kalphul, Unari, Tuthri, Gehai or Bul, Kafondia,	<i>Coriopus lacera</i> , <i>Myrica aspidia</i> , <i>Rubus flavus</i> , <i>Fragaria vesca</i> , <i>Morus parvifolia</i> , — <i>serrata</i> , <i>Eleagnus conferta</i> , <i>Curatua adula</i> ,	Hazel, .. Box myrtle, Bramble, .. Strawberry, Mulberry, .. Oleaster, ..	8000, 4000-6000, .. 5000-7000, .. 7000, .. 4000-7000, .. 6000, .. 7000-10,000, .. 3000-4000, ..	
Kunuk, or Gehun,	<i>Triticum sativum</i> , (two varieties),	Wheat, .. (red and white),	13,000, Highest limit, 15,000, ..	The bearded and awnless wheat occur. The beardless variety is most esteemed. Barley ripens in the end of May, several weeks before wheat. Much cultivated. Cultivated sparingly, mixed with barley.
Ujon, ..	<i>Hordeum celeste</i> , ..	Barley, ..	Highest limit, 15,000, ..	
Jou, Willaiti Jou,	— <i>harastichon</i> , <i>Avena sativa</i> ,	Common barley, Oats, ..	6000-10,000, ..	

CHALINE.†

China,	<i>Panicum miliaceum</i> ,	Millet,	4000-8000, ..	In the middle regions it is one of the chief crops.
Sanwak,	<i>— frumentaceum</i> ,	..	4000-8000, ..	
Kangri,	<i>— indicum</i> ,	Italian millet,	4000-8000, ..	
Kora or Koda,	<i>Paspalum serotum</i> ,	..	5000, ..	This is an inferior grain, only used by the poorest classes.
Jungers,	<i>Pennisetum glaucum</i> ,	spiked millet,	7000-13,000, ..	Confined to the lower valleys.
Ogal, ..	<i>Fragaria virginiana</i> ,	{ Buckwheat,	7000-13,000, ..	At high elevations, these are cultivated to a great extent.
Papras,	<i>— esculentum</i> ,	Ragi, ..	5000, ..	Perhaps the most productive of all Indian cereals.
Mandwa,	<i>Elymus coracana</i> ,	..	7000, ..	This food plant is cultivated on the Neilgherries.
Bathu,	<i>Amaranthus frumentaceus</i> ,	Amaranth,	6000, ..	Grown only in the valleys.
Jowar,	<i>Sorghum vulgare</i> ,	Great millet,	7000, ..	Entirely a rain crop, grows to six feet high, seeds considered nourishing, ripens in October.
Bhatn or Charai,	<i>Chenopodium</i> —	Goosefoot,	..	
PULSES.				
Masuri,	<i>Ervum hirsutum</i> ,	Lentil, ..	5000, ..	In corn fields.
Mash, ..	<i>Phaseolus radiatus</i> ,	Black pea,	6000, ..	The seeds are both black and green.
Urud, ..	<i>— max</i> ,	Black gram,	..	
Betana,	<i>Pisum sativum</i> ,	Field pea,	8000-14,000, ..	Cultivated in Kunawar and Spiti.
Bakla, ..	<i>Faba vulgaris</i> ,	Common bean,	4000-8000, ..	I saw one patch of this kind of pulse.
Bhut, ..	<i>Soya hispida</i> ,	Soy bean,	4000-6500, ..	
Kuith,	<i>Dolichos uniflorus</i> ,	Horse gram,	5000, ..	Much grown in the low valleys.
Urthar,	<i>Cajanus indicus</i> ,	Dal, ..	..
FIBRES.				
Bhang,	<i>Cannabis indica</i> ,	Indian hemp, ..	3000-7000, ..	Grows spontaneously, forming a rank undergrowth. Yields Himalayan hemp.

+ Rice is not observed above 6400 ft.

* This appears to be identical with *R. Himalense*, Royle, fig. in Jacq, ic. t. 77.

Hill Name.	Botanical Name.	English.	Elevation.	REMARKS.
Bichu, ..	<i>Urtica heterophylla</i> ,	Neilgherry nettle,	4000-700', ..	Plentiful at Simla, grows luxuriantly about camping grounds, yields a valuable fibre. Exhibited at Lahore 1864 by several Hill Chiefs. Plant less abundant, furnishes a textile fibre of great value. Used for making common ropes. Cultivated sparingly in fields. Bark much employed for making ropes at Simla and Rampur. A common showy shrub on rocks with white flower and yellow fruit, paper prepared from the bark. Bark used for making shoes. There are two species, common, the bark is used for ropes* and as a paper stuff. Extensively used for ropes and rope-bridges. This grass is used for shoes and rope-bridges. { The tomentum on the under surface of the leaves much employed by the hill people as tinder.
Puya, ..	<i>Bomarea nivea</i> , ..	Rheea,	4000-6000, ..	
Sihtar, ..	<i>B. salicifolia</i> , ..		4000-6000, ..	
Sudokra, ..	<i>Hibiscus cannabina</i> ,		3000-4000, ..	
Behul, ..	<i>Grewia oppositifolia</i> ,		4000, ..	
Jaku, ..	<i>Daphne papyracea</i> , ..	Paper shrub, ..	4000-8000, ..	
Koo, ..	<i>Celtis eriocarpa</i> ,	Nettle tree, ..	6000, ..	
Moorub, ..	<i>Desmodium argenteum</i> ,		6000-9000, ..	
Bhabur, ..	<i>Eriophorum comosum</i> ,		3000-6000, ..	
Hagar, ..	<i>Andropogon</i> , ..		2000-4000, ..	
Kahl or Kupesi, ..	<i>Onoseris lanuginosa</i> ,	Shepherd's tinder,	7000-4000, ..	
Kushul, ..	<i>Apotaxis fastuosa</i> , }			
BASKET MATERIAL.				
Nigala, ..	<i>Arendinaria utilis</i> , ..	Hill bamboo, ..	9000, ..	Used for wicker work, and for lining the roof of houses.
Burj, ..	<i>Salix alba</i> , ..	Willow, ..	9000, ..	{ The twigs are used for baskets and rope-bridges.
	<i>Betula bhajputra</i> , ..	Birch, ..	10,000, ..	

		DRUGS.			
Kurroo,	..	<i>Hyoscyamus niger</i> , .. <i>Geniana kurroo</i> , .. <i>G. Kashmirica</i> , ..	English Henbane, Him. gentian, ..	5000-8000, .. 10,000, ..	{ Abounds in waste, stony places, Rogi Cliffs. Near the eternal snows. Four or five species are found in Kunawar; the largest is <i>G. Kurroo</i> , see Royle's Ills tab. 58, f. 2.
Cherayita,	{	<i>Ophelia paniculata</i> , .. <i>O. purpurascens</i> , ..	Chiretta, ..	7000-9000, ..	{ These annual plants supply the chief portion of the bitter root exported to the plains.
..	{	<i>Leonodon taraxacum</i> , ..	Dandelion, ..	8000-10,000, ..	{ Yields the official extract.
Raeo,	..	<i>Sinapis glauca</i> , ..	Mustard, ..	Up to 11,000	{ Much cultivated. Several species of <i>sinapis</i> are grown as salads and condiments in the valleys.
Jira, ..	..	<i>Cuminum cyminum</i> , ..	'umin of Scrip- ture. ..	7000-9000, ..	{ Abundant in pasture, seed exported to the plains. Found along with the cumin.
Chukri,	{	<i>Carum carui</i> , ..	Caraway, ..	9000, ..	{ The <i>emodi</i> is less active as a purgative, and more spongy in texture.
		<i>Rheum emodi</i> , .. —moorcroftianum, ..	Common rhubarb, Small stalked rhubarb, ..	{ Above 10,000, 3000-7000, ..	
Bhang,	..	<i>Cannabis indica</i> , ..	Indian hemp, ..	8000-13,000,	{ Yields <i>churru</i> , one of the chief articles of trade in Rampur. Seeds and rind medicinal. The roots are much employed as a tonic and febrifuge.
Darim,	..	<i>Punica granatum</i> , ..	Pomegranate, ..	10,000-15,000,	{ The roots are used for destroying wild animals. Root used as a febrifuge. Root largely exported to the plains.
Atees,	..	<i>Aconitum heterophyllum</i> , ..	Atees plant, ..	10,000-14,000, 5070-8000, ..	
Tilia kachang,	..	<i>A. napellus</i> , ..	Wolfsbane, ..	11,000, ..	
Moura bikh,	..	<i>A. ferar</i> , ..	Poisonous aconite		
Byumot,	..	<i>Thalictrum foliolosum</i> , ..	Meadow rue, ..		
Kurroo,	..	<i>Picrothiza kurroo</i> , ..	Bitter root, ..		

* Capt. A. M. Lang R. E. informs me that these ropes have been found very useful. The twigs after being plaited together are soaked in a stream for a few days to make them pliable. They are used to drag heavy trees from the forests, and were employed in pulling beams across the torrent of the Sutlej at Wangtu when tarred English hemp ropes snapped.

Hill Name.	Botanical Name.	English.	Elevation.	REMARKS.
Nepari,	<i>Rumex acetosa</i> , ..	Sorrell, ..	6000-8000, ..	Widely distributed. Used as a native remedy.
	<i>Oxyria reniformis</i> , ..	Mountain sorrel,	6000-8000, ..	
	<i>Delphinium brunonia-</i> <i>nium</i> , ..	Musk plant,	14,000, ..	Smells powerfully of musk. The extract "Resut" is prepared from the root. Used as a vermifuge. Medicine for fowls. } Cultivated in the lower valleys.
	<i>Berberis lycium</i> , ..	Berberis,	3000-9000, ..	
Chitra,	<i>Rottlera tinctoria</i> , ..	White Rue,	4000, ..	
Kamela,	<i>Ruta albiflora</i> , ..	Cress, ..	5000-7000, ..	
Kalim,	<i>Lepidium sativum</i> , ..	Water-cress,	..	
Piria Halim,	<i>Nasturtium officinale</i>,	..	..
OILS.				
Juldaru,	<i>Armeniaca vulgaris</i> ,	Apricot,	..	An excellent lamp oil, exported for sale to Simla.
Tori,	<i>Sinapis</i> , ..	Mustard,	11,000, ..	Very common, several species. The seeds yield an excellent oil.
Bhetkul,	<i>Prinsepia utilis</i> , ..	Prinsepia,	4000-8000, ..	
Bangira,	<i>Perilla ocimoides</i> , ..	"	..	Cultivated for the sake of an oil from the seeds (Madden).
TL, ..	<i>Sesamum orientale</i> , ..	Til, ..	..	The oil most commonly used for lamps at Simla. Yields a fine oil, but seldom procurable.
Pocht,	<i>Papaver somniferum</i> ,	Poppy, ..	..
DYES.				
Manjit,	<i>Rubia cordifolia</i> , ..	Madder,	..	The roots give a beautiful red dye. Used in Govt. Tea-factories to dye the paper put on the chests. Mixed with indigo it makes a good green color. (Jameson).
Chitra,	<i>Berberis aristata</i> , ..	Berberis,	..	

Kaiphah, Ekulbtr,	.. ..	<i>Myrica sapida</i> , <i>Daliscia cannabina</i> , .. <i>Lithospermum eucro-</i> <i>mum</i>, ..	.. ..	9000-11000, .. 4000-7000, ..	Bark used as a dye. Root exported to Amritsar as a dye-stuff.
Birmi or Rakhah Lodh,	.. ..	<i>Impatiens</i> sp., <i>Taxus baccata</i> , <i>Symplocos paniculata</i> , <i>Alnus nipalensis</i>, ..	.. .. .. ..	9000-10,500, .. 7000-9000, ..	Root used as a red dye in Tibet. Yields a red dye. The bark yields an inferior red dye. Used in dyeing with madder.
Kunchor Koish	..	..	..	..	Bark used in tanning, dyeing red and in the preparation of red ink.
Kargela, Hur, ..	.. ..	<i>Rottlera tinctoria</i> , .. <i>Terminalia chebula</i>, ..	.. ..	3000, .. 2500, ..	The strigose pubescence gives an orange dye. Valuable tree, the fruit yields a dye and medicine.
Dhái, ..	..	<i>Grislea tomentosa</i> ..	..	3000, ..	Flowers employed to dye red.

On the feasibility of a mixed system of open air Silk-culture, with reference more particularly to the climate and Forests of Cachar and Assam. By C. BROWNLOW, ESQ.

The best use that can be made of land is turning the original forest vegetation to account, not by destruction, but by conservation.

A forest is a magazine of national wealth to which the wild silkworms are the key.

Cachar as well as Assam abounds in wild silk yielders ; at least twelve species and varieties of *Attacus* and *Antheræa* have been identified by Captain Hutton ; cocoons have been met with which though not yet identified by proper authority, appear to be those of bombyxes, and at all events yield excellent and white silk : and it is by no means unlikely other species exist as yet undiscovered. Particulars regarding the nomenclature, habits, distribution and practical utility of the above-mentioned species will be found in the able treatises of that Naturalist. The object of the present paper is merely to consider the practical use that can be made of these insects, with reference more particularly to the climate and natural vegetation of Cachar and Assam, there being now very little doubt that both these districts closely resemble each other in climate and natural productions.

It requires but little consideration to perceive the advantages of availing ourselves of forest trees as they stand, if they should happen to yield a merchantable produce, whether in the shape of flowers, fruit, bark, roots, or leaves (convertible into silk or not) over cutting down these same forest trees to make room for other vegetation in their place ; for in the one case we avail ourselves of a store or magazine ready provided us and from which we have only to draw, while in the other, having destroyed, we have to commence the work of reconstruction anew. This is no fanciful or theoretical view, but one the practical bearing of which must be acknowledged by any one who has observed jungle vegetation and taken note of the advantage a full grown tree has over a seedling what-

ever may be the nature of the produce demanded of it. The aphorism that time is money, is truly and literally applicable to it. Every tea-planter is aware of the advantage of having had nature working for him and therefore prefers a grove of wild indigenous tea trees ready to his hand rather than that he should have to commence on a *tabula rasa*; in the latter case he reaps no benefit from past time, while in the former many past seasons concur to his advantage. Whilst the jungle tea plants were growing unheeded in the yet unreclaimed forest they were gathering strength and substance year after year and extending their roots wider and wider, and it is the planter who ultimately derives the benefit of this accumulated root power which in one year gives him a larger tea bush than he could procure from the seed by cultivation in four. Nature has in fact been cultivating for him. The practical bearings of this fact have not escaped the Assamese, who, to their credit be it said, have had the intelligence and ingenuity to avail themselves of the superior vigour and leaf producing power of full grown forest trees; and not only this, but they have also had the sense to perceive the advantages of an out-door over an in-door system in other respects; by taking the worm to the leaf instead of the leaf to the worm, they imitate those conditions in which the worms exist in their wild state which must necessarily be the most favourable; they save a great deal of labour in carriage of leaf, obviate partial fermentation and drying, and ensure a full and healthy development of the insect.

The only defect to be found with their system is its incompleteness, and their not supplementing their cultivation with the Atlas and Cynthia worms, as well as others, which, particularly Atlas, would enable a vastly greater number of trees to be utilized which otherwise must be cut away to make room for *Antheræa* seedlings taking many years to come to maturity. There is probably some good reason for their neglect of the last two mentioned worms; they, and the trees they feed on, could scarcely

be totally unknown to the people, and the probability is the difficulty of unravelment they are known to possess, and the slowness, tediousness and inefficiency of the carding process, 'as known' to the Assamese, are the chief if not the only reasons of their not being adopted.

In the advanced state of perfection to which European carding machinery has reached, and the greater facilities afforded by chemical science towards effecting the unreeling, these objections ought not to have so much weight : particularly as in an out-door system the Atlas and Cynthia worms being rejected the number of trees available for silk would at once fall to a fourth or even less.

The Assamese have introduced their open air system into Cachar wherever they happen to have settled, but the Hindus Mahommedans, and Munipoorees, ignore sources of wealth not recognized by their ancestors, and seem in no way inclined to avail themselves of the hint offered them by these settlers; they have even no names for their wild silk-worms beyond the rather vague and wide embracing term "pookh"

Some few villagers make use of the Tussur cocoons which are spun yearly by the wild worms on the *Zizyphus* trees in their compounds, but they go no further than this, and will take no trouble to rear a brood of wild worms and place them on the trees, nor to keep watch. The Eria or Renri worm (*A. Ricinus*) is trained by Cacharees, a hill people, resembling the Munipoorees and Assamese in their features, in isolated villages in the hills; but the total extent of this cultivation is very small and it seems to have no tendency to spread among the people of the plains.

The cloths made out of this silk are much in esteem where they can be had, for their durability, but their manufacture is coarse in the extreme, and besides being full of gouts and irregularities, they form a pile or fluff which contracts dirt very readily. The process of carding, as carried on by these people, is tedious in the extreme. The cocoons are taken by

the women, whose sole department this is, and placed in a mixture of cowdung and water, and when they have been well softened the silk is gradually drawn out by sheer force in a thread more or less uniform according to the skill of the winder: in this process it is rather an advantage for the moths to have escaped, and the drawing out of the silk is commenced at the open end, the bundle of fibres as it issues from the cocoon is wound on a spindle, and is afterwards spun into a thread, the uniformity and appearance of which are much improved by its being run several times between the fingers or through a piece of tow or silk. However skilfully this process of carding may be accomplished it is at the best a slow and inefficient one, and raises the cost of the cloth enormously beyond what it would be if there were some more facile way of reducing the cocoons to thread.

Before proceeding to describe the *modus operandi* in a piece of silk cultivation, it will be necessary to make a few remarks on the distribution of those silk trees which are most promising in respect of utility or abundance or both.

Any considerable portion of upland (1,000 acres for instance) that may be taken up in a block will be sure to consist of both upland and alluvial land, and of these the proportions vary, the alluvial in many places constitutes a half, sometimes a third, and is seldom less than a quarter.

If the grant should be situated in an uninundatable part of the country, the outlying portions of the alluvial land will generally consist of tree jungle containing a large proportion of silk trees, patches of from ten to fifteen large trees in each patch will generally be found, called by the natives Chelita-oora and consisting of *Dillenia speciosa* alone or with little intermixture, on this the Atlas worm feeds.

The Juki or Ooriam, (*Andrachne trifoliata*) one of the Moo-ga trees, will also be found pretty evenly sprinkled over such land at the rate of from two to three trees at least per acre, and more uniformly than *Dillenia speciosa*.

The *Ficus Indica*, Butt or Banian, the food of another species of *Antheræa*, also affects such lands, and may generally be found, one to every ten or fifteen acres and of a large size.

"The alluvial land lying within the borders of the upland and divided and enclosed by it in strips of varying width and length (called by the natives "towars") is generally too defective in its drainage to admit of tree jungle, but here and there, intermixed with the null and ekur grasses, there may be found a swamp tree (Heejol) fed on by the Tussur worm; this tree taken alone is too sparse, but might be made use of in cultivation in conjunction with other trees.

Ascending the uplands we shall find, particularly in *secondary forest, the Soom (*Tetranthera lancifolia*) which scarcely occurs on alluvial land, in considerable numbers, averaging perhaps four or five fine trees to each acre besides saplings; this tree should be especially sought after being one of those on which the Mooga worm feeds.

In deserted "jhooms" of ten or twelve years standing, large patches of fifty and sixty acres in extent will be found to consist almost entirely of koorkooree and a *Gordonia*? Wild tea never occurs in anything like the density and abundance of these plants, the land is occupied by them over large tracts quite as advantageously as it could be were they cultivated, and all that is required is that they should be thinned out by the hand of man instead of being left to the natural process which is tedious and irregular.

Where these plants occur, so completely is the land shaded by their closeness and regularity, that weeds can gain very little ground and are easily checked.

* By this I would be understood to mean that sort of forest not necessarily very recent or of small growths, which takes the place of the primitive forest, when that has been removed in Kookee or Bengali cultivation, and when at the same time the land has not been too much scourged or interfered with by cattle grazing, wood cutting &c. for in this case, as I have before had occasion to remark, instead of forest, bamboo weeds, scrub and grasses get the prevalence and hold it.

Such patches as these would prove most valuable in a mixed system of cultivation as both of the trees are fed on with avidity by the Atlas worm. Even allowing the necessity of carding the silk and its consequently inferior value, these drawbacks would be compensated, in a great measure, by the yield that land so advantageously occupied would give, the facility of protection against birds, and the low cost or rather the small amount of labour,* by which the weeds might be kept down on the overshadowed land, to say nothing of the advantage of having ready grown trees.

Those can best appreciate the advantage of having their land in this overshadowed state who have experienced the trouble and expense and the frequent failure sustained in getting their plants, whether of tea, coffee, fruit or any other objects of culture, into that advanced stage in which they overtop and overshadow the weeds, and are in no further danger of check or destruction from that source.

In such tracts of primitive forest as there may be in the grant, wild mango and black varnish trees will be sure to occur in considerable numbers, the foliage of which is convertible into cardable silk, through the medium of an abundant, social and very hardy silk producing bearworm, *Cucula* sp., to be described hereafter. Thus both upland as well as alluvial will be found to possess large numbers of silk trees, which it only requires the industry and intelligence of man to turn to a good advantage by availing himself of what nature has done for him and supplementing her deficiencies. Any one who attempts rearing silkworms on jungle trees will not be long in finding out that the shape of these trees as they exist wild is by no means the most favourable possible. In the original forest they are by mutual influence drawn up with long stems, and want of pruning has given them wide straggly heads; in these heads, though there is no deficiency

* Money by no means implies labour, especially in Cachar, where a planter may have his chest full of rupees and not a local labourer on the garden.

of foliage, it occupies more space in surface than in depth, and is in detached and disjointed portions.

The difficulties presented by these defects, when it is attempted to rear worms on the trees, are by no means small ; in the first place the long bare stem is a disadvantage, when it is considered that the tree must be climbed, both to put the worms on it as well as to remove the produce ; and the foliage being in detached masses, makes it necessary to apportion the worms, not only to the whole foliage, but to every individual detached portion of it : besides this the worms being unable to reach more food when they have consumed that they are on, without returning by the main stem, are liable to become restive.

In gathering the cocoons also, the more straggly the head the greater is the risk to life and limb from loss of footing and weak branches.

On the other hand there can be no doubt that if it be attempted to alter the shape of the tree, and to give it a shrubby habit, by cutting of the head together with more or less of the stem, the tree both sustains a great shock, from which it takes a considerable time to recover and to reproduce a system of branches of equal extent with those it lost.

When once however the tree had recovered its strength and had formed a close and dense head of foliage not too high from the ground, both the apportioning the worms to the tree and removing the produce would be greatly facilitated. The work people (who have generally an inveterate dislike to climbing, and no wonder ?) would easily be enabled to reach the larger boughs from the ground, and by means of them the very extremities of the smallest twigs, which might then by a regular system of pruning be easily kept within reach, and as all the extremities would anastomose, the worms would be enabled to move about freely in search of their food by the outside instead of the inside, and owing to the multitude of twigs would be little likely to disturb each other ; the

cocoons also would be more uniformly distributed over the tree and could be easily got at and detached. Of trees, when pollarded, all are not alike in their reproductive power. Tea for instance suffers very little from the process, and has at the end of a year all its original foliage and more. *Andrachne trifoliata*, *T. lancifolia*, *D. speciosa*, are also, especially the first, quick reproducers ; but this is not the case with *F. Indica*, *Nauclea Cadamba* and one or two other silk trees, which should therefore be left in their original form.

As to the length of stem which should be left to form the framework of the future tree ; if the stump be too short there will not be room for the simultaneous production of a sufficient number of boughs to support the full quantity of foliage the tree is capable of producing. From trials made it would appear that in most cases a stem of ten feet in height affords ample room for boughs to produce a fine and symmetrical head ; a greater length of stem would therefore be unnecessary and only throw difficulties in the way of climbing.

The reduction of the tree to this height should be performed in two operations ; the first at some height above the ten foot point, in order to allow for lacerations, which will necessarily take place owing to the great weight of the upper portion of the tree, and its being generally more or less out of the perpendicular ; the second operation should remove the lacerated portion with a sloping cut so as to avoid canker.

Previous to reducing the trees to the shrubby form which would seem on the whole to be the most advantageous, the foliage already on the trees may or may not be converted into silk ; if it should be decided to take off a crop a sufficiency of worms should be placed on the boughs near their junctions whence they will find their way to the extremities ; the worms having consumed the leaf and spun, the entire boughs should be lopped down, at as near their junction with the main stem as possible, this is easily accomplished with a common dhaw, as the horizontality of the boughs greatly helps their breakage ;

the cocoons should then be gathered from the fallen boughs. The branchless trunk should now be reduced to the proper height, as previously directed; this being done in June and July the trunks will give little or no leaf that year all their energy being consumed in forming buds, but by the setting in of the rains in the following year, the trees, though they will not have attained the full development they are capable of, will yield a very fair crop of silk.

The shrubs (for such they are now) should of course be pruned regularly at the commencement of the cold weather, a proper number of leading branches only being left, and the shoots not allowed to become straggly. The labour required to effect this is very insignificant. When once the shrubs have got back their full strength they will bear being stripped of their leaves twice a year for many years in succession provided they are allowed the six months from November to April to recruit.

In forming a silk plantation too much stress cannot be laid on the necessity of care being taken that the roots of the trees shall not be cut in hoeing.

The roots of all jungle trees, and especially on uplands that have at all a steep pitch, are very superficial and easily injured, and if in the course of hoeing the plantation over all the roots met with at a depth of even six inches be cut indiscriminately, the trees will sustain irreparable damage; the damage may not show itself immediately, but will soon be perceived in the sickening of the trees and their death perhaps as long as one or two years after.

In a tea plantation of course injury to the roots of the forest trees is not avoided, on the contrary it is rather an object, but in hoeing up the land for silk, something narrower and with a less extent of cutting edge than the common kodallie would be necessary. Having reduced to a proper shape all the trees available for silk that are already on the land, the next object of a silk cultivator will be to fill in the vacancies: to do this to the best advantage it will be neces-

sary to select from among the known silk trees one which at the same time that it yields a good unreelable silk, also strikes readily from cuttings, as the method by seedlings is generally tedious and uncertain.

I know of no tree that unites in itself more of these desirable qualities than the Ooriam (*Andrachne trifoliata*.) Large sized boughs of this tree placed in the ground and supported by a tripod of bamboos become in the course of one year immovable trees, and the worm that feeds on it is the Mooga, than which none can be of a more desirable quality in every respect; besides these advantages the tree is of sufficient abundance on low lands to afford an ample supply of large sized cuttings. None of the other Mooga trees strike with sufficient readiness from cuttings; and the Soom, *T. lancifolia*, though desirable in other respects, is a very slow grower when raised from seed. The cuttings should be planted at the time the natives choose to put in their plantain and other fruit trees, and if possible not later than July.

In this sort of cultivation it would not be admissible to burn the jungle as it lies on the land, as is done in forming a Tea plantation, as the injury to the foliage and bark of the trees would be too great; all bamboos therefore and undergrowth, together with the trees that are not required for silk, should be either thrown off the land or else burnt in heaps at a proper distance from the trees that are to be preserved.

The fruit yielding power of the trees is much impaired after pollarding, and in most instances entirely suppressed; this is probably an advantage as far as the yield of leaf is concerned, and at any rate is no draw back.

Having given some idea of the method of forming a plantation, it will next be necessary to point out the difficulties to be encountered in rearing worms in the open air.

These are hail, wasps, ants, crows and other insectivorous birds, lizards, ichneumon flies, and the unusual early setting in of cold. Mr. Hugon mentions in addition bats and owls.

The lizards and flies may almost be neglected. Crows and other insectivorous birds are easily deterred and do by no means so much mischief as might be supposed; a boy with a good pelletbow going from tree to tree might easily protect from six to ten acres of trees during the critical time which, however, is not over a month.

Wasps, large and small, (particularly the large) are very destructive, as also a species of ferocious and venomous stinging ant, (*Dulhyapipra*) which exists in immense numbers in the hollows of all trees and a single sting of which is death to the largest worm; unfortunately too they invariably use their stings for numbing their prey, if it should show signs of resistance, in the attempt to drag it away. Both this ant and the wasps kill much more than they actually want for food and hence are serious evils to be got rid of if possible.

A fluffy net placed over the tree would keep out the wasps, but as this would scarcely be remunerative, a certain percentage (which at all events would not exceed five) must be allowed for their depredations; placing decaying fruit or *goor* near the trees might possibly divert them from the worms. The ants can fortunately be got rid of to a great extent by a method adopted in Assam, viz: by putting a plate of decaying fish at the foot of the tree which will not fail to attract them in large numbers; as soon as the plate is full, boiling water is poured on, and this process is repeated until the diminishing numbers show that there are comparatively few left; in addition to this, boiling water might be poured into the hollows, and sulphur smoke injected with a pair of bellows would probably have an excellent effect. * In shaping the trees however much may be done towards obviating the nuisance of ants by leaving no laceration, which might afterwards form cankers and give them a lodgement.

Hailstorms if severe would certainly prove very destructive, but in most years the severest storms are over by the middle of April i. e., before the worms are hatched, and if the first crop

or bund should be ruined by severe hail in May,—such as we had in 1864,—there would be the more leaf for the second brood in September at which time hail has never been known to fall in this district. The second brood may however suffer from another cause; should the perfecting (or the ripening as the Assamese call it) of part of the worms be protracted into November, and should there at the same time be an early setting in of cold, the worms become very uneasy, descend from the trees and spin prematurely on whatever comes in their way. We lost a whole brood of Moogas in this way once, but the Atlas is more hardy and does not suffer so much from this cause.

The next point to be considered is the raising of stock for the plantation, this part of the business will require great care and attention as upon it depends the whole success of the speculation.

Without actual experiment on a large scale it is impossible to state exactly the course to be pursued in this department as modifications might be necessary which it is impossible even to guess at without actual trial on such a scale. With our present experience, the following seems the best course to be pursued in obtaining a supply of eggs:—a sufficient number of healthy breeding cocoons should be set apart either from the plantation or the stock trees; in apportioning the sexes the females can be distinguished from the males by the experienced eye with a very small percentage of error, by their greater size.

The equality of the sexes being observed the cocoons should, when about to hatch, be hung on a tree (either that proper to them or any other), having a roomy and not very coarse net placed over the whole, so as to keep in the males; too great a number should not be placed under one net or they might disturb one another. It may be asked why a large room should not answer as well; the reason is because the moths immediately find out they are not in a state of nature, hence they become alarmed and will not visit the female. The moths do not

unite the same night they issue from the cocoons ; they take the remainder of the night to develop their wings and the female to eject a watery fluid, with which the body is filled.

* The pairing does not take place till the next night, and the process of impregnation lasts the whole of this second night and the day succeeding, in the evening of which, as the process is nearly complete, the male should be driven away and the female shut into a basket to lay ; if they be left they will both take flight during the night ; the female remains quiescent on the cocoon from the time of her issuing till when about to lay. She can with ordinary care be carried about without letting go of the cocoon, and as she never goes in search of the male she requires no tying, which process only irritates and disturbs her though some seem to consider it necessary.

The pairing off and laying of the whole batch should be finished in the course of a week, within which limits the bulk of a wild brood (if healthy) do not fail to appear. The manual approximation of the male and female moths as practised by the Assamese with the more docile *Eria* and *Mooga* moths would probably be unsuccessful with the wild *Attacuses* and *Antheræas*.

In order to ensure success in all operations with wild worms it will be necessary to have a due regard to their habits, which are somewhat different from those of worms which have been cultivated through several generations ; the former inherit a considerable share of wildness from the egg and will not bear handling or moving about in the way cultivated worms will ; any motion to which they have not been accustomed, such as a jar, will disturb them and set them wandering, and the same remarks apply to the moths.

The stock trees before mentioned are trees which it will be found necessary to have in order to secure as large a supply of eggs as possible from the jungle cocoons with which the plantation is to be started. Of these trees there should be one species (not necessarily more) answering to each species of

worm. No dependence can be placed on procuring a sufficiently large supply of cocoons from the jungles to stock a plantation at the out set; on the contrary so sparsely do they occur in their wild state that after a diligent search the planter may be rewarded with perhaps a single female of a certain species: of this he must make the best, he will rarely fail to secure a mate by mere exposure, and in order that he may lose as few as possible of the progeny he must resort to the stock trees before insisted in. These trees should be situated for convenience sake as near the houses as possible, and should be provided with a fine net, not necessarily as large as the propagating net, but having meshes of sufficient smallness to keep out the small wasps (bullahs) which are especially destructive to the young worms and will scent out and attack them in a verandah or even inside the house; the stock tree should also be well purged of ants and other vermin.

After frequent trials we have found rearing the worms in doors, whether on trays or on branches placed in bottles of water to be very unsatisfactory, sooner or later it is necessary to disturb them to change the leaf, and this sets them wandering over the edges and underneath the tray, so that it is sometime before they find their food again.

Unlike the more docile *Eria* the wild worms will not feed in close contiguity and appear to disturb each other. Whether any change will be brought about in the habits of the wild worms in this respect it is for a lengthened course of experiments to decide.

The wild Mooga of Cachar, which there can be little doubt is identical with the *Antheræa Assama* or cultivated Assam Mooga,* shows in its wild state the same want of docility with

* If there should be any lingering doubt in the minds of naturalists as to the absolute identity of the cultivated Mooga of Assam with the wild worm of Cachar above referred to (which unfortunately has no native name here), it ought to be set at rest by the consideration that besides the identity in appearance, which no authority has yet gainsaid that I am aware of, the worm of

all other *bonâ fide* wild worms; but we see the Assamese have in the course of time overcome this wildness, and induced the moths to pair readily in captivity, and the same result may therefore be looked for in the case of the Atlas and of all the wild species that man should find it worth his while to domesticate or train.

The climate of Cachar is favourable both to the growth of silkworms as well as to quick reproduction: the warm and moist atmosphere which prevails from the setting in of the rains in April to somewhat beyond the Autumnal equinox, affords a stimulus, and encourages quick development in all the stages of insect life; during none of the breeding months, and they comprise the hottest of the year, does the heat of the sun seem to check the growth of the worms or injure them, unless they happen to be exposed to its direct rays; protected by their leafy covert they endure even the broiling days of May without suffering in their health as is shown by the first brood being in no way inferior to that which, coming in, in the latter part of October and commencement of November, enjoys a portion of cool weather; indeed as has been before mentioned, in the case of the Mooga at any rate, I have observed cold check development and produce a decided injury to the health of the worms; there would seem therefore to

Cachar has been found to feed in a state of nature on two of the identical trees on which the Mooga is cultivated in Assam; and this in primeval forest and at a distance of a hundred miles from the nearest silk cultivation. Moreover, in Cachar, no other silk yielder that could be mistaken for it has yet been found to feed on these trees. The inference is that the Assamese (in the case of these two trees at least) have availed themselves of natural adaptation, and trained the worms on those trees on which in the first instance they found them wild; and this supposition is strengthened by the fact that the wild worm of Cachar is by no means a diffuse feeder like the Atlas but feeds on a very limited number of trees and those possessing for the most part aromatic leaves.

M. Perrotet, Pondicherry, notes the exceptional occurrence of four generations of the *Saturnia Mylitta* feeding on the *Zizyphus Jujuba*; this worm is probably the same as the Cachar Tusser feeding on the same tree.

be strong reason for concluding (in opposition to ideas hitherto prevalent), that the moist and warm climate of Assam and Cachar, natural to the worms, is the best for them in every respect, so long as the natural conditions they exist under are not altered.

Two broods at least of wild worms are comprised between April 15th and November 15th. The first brood attain maturity at the end of May and commencement of June and the last at the end of October and during the first few days of November. Some irregularities are occasioned by the stragglers of each brood, of which there will be sure to be some even out of the same batch of eggs; though the irregularity in the hatching of the eggs seldom exceeds a day or two there is room for and in all probability does exist a middle brood between the two before mentioned. We have met with full grown worms late in August, it is very improbable that these should be stragglers of the first brood, and they in all probability belong to a distinct or middle one; of the existence of such a brood (though strongly suspecting it) I have not however been able to satisfy myself.

The worms of the last brood, which as before stated spins in the latter end of October and beginning of November, lie dormant in the chrysalis state, through the whole of the cold weather, through the whole of the hot though not moist month of March, and do not turn into moths until about the 15th April, thus again originating the cycle. Chrysalides of the Mooga and Tussur occasionally turn in January and February. The eggs take about eight days to hatch. Even if there should be three broods it is doubtful if any advantage would accrue in a silk garden from making use of all three instead of two only, the first and last. The trees themselves would have to be considered as well as the worms, to strip them too frequently of their leaves would be like killing the goose that laid the golden eggs, and probably after all produce little extra gain to the cultivator beyond what would accrue if the plants were allowed

plenty of time to put forth and ripen their foliage. There can be no doubt that crude unripened foliage both yield an inferior quantity if not quality of silk and are also less wholesome food for the worms than foliage which has had a proper amount of sun and air.

I now append a list of the forest trees fed on by those worms which are likely to be of practical utility in silk cultivation, and in order that the identification of the trees may be rendered easier I have to the best of my ability delineated them. The native name has been given except when there was none, but it is not to be depended on,* some names being purely local while others are common to Cachar, Assam and indeed the whole of Bengal, as the Baer, the Chelita and the Kadam. The trees given are those that have come under my own observation, but the list is probably far from exhausted, especially with regard to the Atlas which seems more entitled to the term omnivorous* than any other. Probably were proper search to be made the list might be doubled if not quadrupled, and it yet remains to be ascertained how many trees there are on which the worm does not occur in a state of nature, but on which it would nevertheless be found to thrive; if for instance the "Ping," *Inga* species, (*Mimosæ*), which is the food of a silk producing Sphinx should be congenial to the Atlas, the percentage of Atlas trees would at once be greatly increased; this tree being one of the most common and generally distributed of any. As has been before stated, even if science should not succeed in overcoming the unreelableness of the Atlas cocoon, it would still be worth cultivating as a cardable silk, owing to the great abundance in which it might be grown; where the other silks could only be produced in seeds this might be obtained in maunds, and might even under a proper system of

* I once reared a female Atlas moth on a tree not selected on account of its being the food of the species but simply the first that came to hand, some eggs happening to be on the tree I found about a month after a fine brood of healthy silkworms on the tree

culture cost very little more to produce than the fine and long stapled cottons. The Atlas trees are;—

1. Phakheera.—*Cinchonacea*?, foliage slightly bitter, stature middling, tolerably abundant.

2. No native name,—probably a laurel, foliage redolent of prussic acid, fruit like a plum, kernel containing a large proportion of oil resembling that of bitter almonds, stature large, not very common.

3. Could not find out any native name, but the tree may easily be identified by its resemblance to the China tea plant and its frequent occurrence as a weed in tea gardens, where it is often left by the weeders by mistake for tea; stature middling, common in Jhoom lands, less so in primitive forest.

4. Nagdana, *Artemisia* sp. ? An annual, and one of the most common of jhoom weeds, it may be known by the satiny pile on its leaves, which rubbed in the finger and smelt cause sneezing,—they possess a scent similar to lavender,—the Cachar name is quite local, and is probably given to it because of its fragrance. The true Nagdana is the *Boswellia thurifera*; this plant is too small in stature to be available as a silk tree for which in other respects its abundance peculiarly fits it.

5. Monphul (Cachar name) known in Dacca as the Mynakata, a thorny, rapid growing fruit tree, not indigenous, but found in great quantities self sown about the villages; the fruit is somewhat smaller than an apple but except in being yellow has a good deal of resemblance to that fruit: the fruit is cut up by the natives into slices which are threaded on a string and hung up in their houses to smoke and dry. Stature middling.

6. Palos, a rapid growing weed which affects new clearances, the deep green of the leaf, with the elongated delicate red leaf stalks, enable it to be easily recognized; very common and of large stature, fed on also by *A. Canningi*.

7. Koorkooree, one of the commonest of "Jhoom" weeds; it invades and monopolizes large tracts of land exclusively or very nearly so, grows to a middling stature, and where abun-

A mixed system of open air Silk-culture,

dant shades the ground completely ; this tree is one of the most eligible for training the Atlas on.

8. Lutki, *Obeckia*, the common conspicuous pink flowering plant ; it scarcely grows large enough to train silk on, but the silk off it is very white.

6. Bon Chelita, so called probably from a resemblance in the grouping of the leaves to the Chelita ; a large, hardy rapid growing tree, sufficiently common for purposes of silk cultivation.

10. Kadam, *Nauclea Cadamba*. A common large leaved rapid growing tree, especially on new clearings, where it soon, if allowed to grow, overshades the land ; well adapted as a nurse for young tea or any delicate plants, the leaves become of great size when the plant is young especially on rich hill lands ; as the tree grows larger they diminish in size, occurs mostly on hill lands, seldom on alluvial.

11. Chelita, *Dillenia speciosa* ; a large sized luxuriant tree partial to alluvial lands on which it may be found in clumps or groves, grows very well even in badly drained soil and with water about the roots ; owing to the large size of this tree, its growing in clusters and the large quantity and bushiness of its foliage, it is eminently adapted for training the Atlas worm on.

12. Boidraj, *Cedrelaceæ* ? A large sized and very common tree in old forests, Atlas silk off this is very dark. This tree is very common in the Sylhet district and occurs all the way down to Dacca.

13. Lood, also a full sized tree, may be known by its dark green shiny leaves, and its bark which is thicker than that of probably any other tree ; this tree is also fed on by the *A. Canningi*.

Attacus Canningi trees. Besides the two trees before mentioned which are fed on by this worm as well as by the Atlas viz. the Balos and the Lood, there are :—

1. A small annual, apparently an Amaranth, which would not be available for cultivation.

2. The Honoor, a large sized tree sufficiently common. On this tree I have in some seasons seen the worms so abundant naturally as completely to strip it of foliage. I was unable to obtain a drawing of this tree.

Mooga or *Antheraea Assama* trees.

1. Hocara or Boocara. This is one of the trees on which the Mooga is cultivated in Assam where the tree is I believe called Aownla or Owla, its leaves are somewhat aromatic and are almost round, with their venation very much in relief. Great destruction of this tree takes place in Cachar for tea box wood; it might be turned to a more profitable use by rearing silk on it; it is very common both on low and uplands.

2. A Laurel, having a considerable resemblance, both as regards shape, aroma and flavour of the leaves, to the common cultivated bay, the foliage is however much larger and coarser, limited in quantity but growing to a large size.

3. Phooair sp. This tree which is somewhat less common than the "Soom," hereafter to be mentioned, is nevertheless one on which the worm thrives very well, the leaves are aromatic and in other respects it has a considerable resemblance to the Laurels and will probably be found to belong to that family.

4. Cheng Phisol.—This is the Cachar name; in Assam it goes by the name of "Soom," which is stated by Masters to be the *Tetranthera lancifolia*, Lauraceæ. I have in Cachar met with two varieties one more aromatic than the other, it is found in the shape of large trees in primitive forest but is much more common though of a less size in relinquished Bengali and Kookee* Jhooms on hill land. This tree presents in Cachar as in Assam great facilities for rearing the worms as where it does occur it is in considerable numbers together, it is rapid growing, soft wooded so as to make pruning easy, and when cut over forms a fine bushy tree in a short time.

* It may be mentioned once for all that a "Jhoom" is clearance made by either Kookees, Nagas or Bengallies for purposes of cultivation.

5. Kanta Hingra.—*Castanea* sp? This is an umbrageous tree with plenty of dense foliage, the new growths are a fine velvety red, where the tree does occur it generally may be found that there are more in the neighbourhood; four or five such trees well cultivated would occupy one acre of ground advantageously, and properly tended would yield no small return of a fine silvery silk. The other oaks, of which there are many, deserve trial to ascertain whether any of the known silk-yielders will feed on them, as they seem a likely class of trees.

6. Butt, *Ficus Indica*.—Every here and there, and especially on the low lands, one of these trees either standing alone or else in union with another tree, may be found, its wide spreading head covering a great extent of ground; I do not think vicious pruning would answer for this tree, the silk from which would have to be procured by climbing or else by causing the descent of the worms when about to spin as is contrived by the Assamese.

7. Juki, *Andrachne trifoliata*.—This tree is called Ooriam in Lower Bengal and may be known by its triple serrated leaves, and its deep red short grained wood, as has been mentioned before. This tree possesses great vitality and strikes readily from cuttings of whatever size, and its general distribution on low lands makes it a very desirable tree and one by no means to be omitted in an out door silk cultivation.

Tussur and *A. Frithii* trees.—The cocoons of these two species are very similar. The Tussur occurs on

1. Ram dallah; this occurs in great numbers on deserted Jhoom lands or old clearings, its appearance is very peculiar owing to its fronds being upwards of six feet in length and all radiating from the main stem. I have also found on this tree cocoons resembling those of the mulberry worms, but never could procure the moth.

2. Boice, Baer of Bengal, *Zizyphus Jujuba*, not indigenous nor to be found in the jungles except in the vicinity of Kookee Jhooms, abundant near the villages where a large amount

of silk might be procured off them if the villagers were supplied with seed and the demand for cocoons was steady.

3. Heejol, a swamp tree occurring in great numbers along the bases of hills and in the swampy low lands which intervene. Whether it would be worthwhile to embrace these trees in a system of culture remains for experiment to decide, but I do not think the obstacles presented by the swampy ground to communication between the trees are insuperable. There is one advantage *viz.* that the water in which the trees stand would keep away some depredators, such as lizards and owls.

A. *Frithii* feeds on ;

4. Phooair sp. A common jungle as well as village tree, being probably sown from wild seed by the villagers for the sake of its oval sour fruit; the leaves become a bright red before they fall, common and of pretty large stature.

Cucula trifenestrata—This hardy and abundant worm produces a silk, brilliant in appearance but which can only be carded ; we have found large quantities of its cocoons on several trees but at present only remember,

5. The Dolijam or common indigenous tea.

6. The Luckiam or wild mango, an abundant tree and one growing to a large size.

7. The Am Jhoya or blackvarnish tree ; the one the foliage of which resembles that of the mango. The *Cucula* silk is used in Assam for adulterating *Eria*, owing to the abundance in which it is procurable in the forest.

Having thus pointed out a number of the trees which might be used for silk training, which number I am convinced might be greatly increased by further observation and experiment, it remains to point out a few of the advantages possessed by the cultivation of silk on full grown trees over that of tea, coffee, or any other plant, even supposing the produce of each per acre to be of equal value. 1stly, then in silk, that first and most laborious preparation of the land which is necessary in all other cultivation preparatory to put-

ting in the seed or plants is dispensed with. 2ndly, with other plants than those ready grown in the forest there is for one, two, three years and even more, a constant struggle against the weeds, and should these, owing to failure of labour or other unforeseen circumstances, which in practice do frequently occur, gain the mastery for any long time, the whole of the previous operations are rendered null; but in silk the trees have already and while in the forest grown to such a height as to be out of the reach of the smothering influence of weeds, so that these gaining the mastery, though it might for a time affect the yield of leaf, would not produce actual death. If a silk plantation should even be forsaken and run up to jungle the trees would survive and it might again be resumed.

3rdly. In silk, weeding and other operations are rendered less expensive because they require to be less frequently repeated owing to the over shaded state of the land.

4thly. Whilst tea takes four years and coffee five, to reach their prime, up to which time capital lies in the ground, a silk tree is capable of producing as much the first or at any rate the second year as at any subsequent time.

5thly. Not only in cultivation would the labour required in silk be less, but also in subsequent processes, and reeling & ream employments, requiring no great effort but constant attention, are suitable to the nature of the Bongali; numbers of men, boys and women would also attend a silk filature who could not be induced to attend a tea or coffee plantation.

I have thus pointed out as clearly as my limits would allow the advantages possessed by a system of silk cultivation by wild worms over that by domesticated worms; and indeed over any system in which it is necessary first to remove the original forest and then to wait for a long period for the returns.

I do not pretend to have indicated the exact course to be pursued in practice, being too well aware of the difficulties

to be encountered which, although unforeseen, invariably present themselves in carrying out any scheme, particularly of an agricultural nature. I shall be satisfied if I have convinced such as are capable of taking an interest in the subject of the feasibility of the project; and that in the carrying out of the details there are no obstacles which are insurmountable, with sufficient capital, patience and—what is especially needed for the successful conducting of sericulture,—intelligence.

It is not to be expected that merchants will risk capital in a path of speculation so perfectly new, and untrodden as this. It is the function of Government to lead the way and show what can be done, for the encouragement of future capitalists; this it has not been slow in doing in the case of Tea and of Cinchona, and the results speak for themselves; it is to be hoped, in a new branch of agriculture so promising as this, its encouragement will not be wanting. A lakh of rupees laid out in carrying out the experiment on a proper footing would be no great expenditure even if it should turn out fruitless. Considering the great results at stake let Government address itself to procuring and perpetuating all the different species of wild silkworms by means of an establishment as in pisciculture; let it also strive to increase the list of trees that are and may be made available; let it also publish its results, and speculators will not be long in coming forward, by whose agency Eastern Bengal may yet become a great silk as it is becoming now a great Tea producing country.

Observations on three nearly allied species of Dendrobium. Extracted from a letter to Mr. GROTE, from the Rev. C. PARISH, of Moulmein.

I believe that I have just seen my way clearly between *Dendrobium moschatum*, *D. calceolaria* and *D. Dalhousiana*.

num. It would seem that until this morning I had never seen the true *D. calceolaria*, strange though it may seem. I have always been puzzled with *D. moschatum* and *D. calceolaria*, No. 36 and 37 of *Lindley's Gen. and Spec. of Orchidaceous Plants*, always inclining to the belief that the descriptions referred to above were really those of one and the same plant under different aspects—slight varieties perhaps. So, (although I know now that I should not have done so,) I have used the names *D. moschatum* and *D. calceolaria* indifferently for the same plant. For the plant hitherto known to me, as common here, (and called by me *D. calceolaria* in my last letter on the subject to you) I should have used only the name *D. moschatum*. Between this last and *D. Dalhousianum*, it has always appeared to me that the diagnostic marks were sufficiently clear and therefore I was somewhat surprised by your asking me if I could distinguish between them.

I see now however, that you (with Anderson) and I were at cross purposes, for I have now the true *D. Calceolaria* and *D. moschatum* lying side by side on my table, and I do not so much wonder at your asking for diagnostic marks between *D. calceolaria* and *D. Dalhousianum*.

However I think I can help you.—

A neighbour of mine, to whom I have from time to time given orchids which I did not want, sent me in yesterday morning a solitary flower of a *Dendrobium* from his compound to ask me the name; upon looking at it, I was puzzled, for there was something about it which said clearly it was not *D. Dalhousianum* and yet it was not (decidedly not) *D. moschatum*. It was, in some respects, between the two.

I went over this morning to look at the plant and examine the pseudobulbs for I knew that would at once settle whether it were *D. Dalhousianum* or not. I found it was not *D. Dalhousianum* for it had not the red lines on the leaf sheath, the ~~very~~ ^{fallible} mark of that plant. The stems were those of *D. moschatum* and the flowers were (almost) those of *D.*

Dalhousianum. I perceived then that I had hit upon the true *D. calceolaria*. And on comparing the flowers with Lindley's description in No. 36 and 37 aforesaid, I recognised the correctness of his description.

Though I have not *D. Dalhousianum* in flower just now, I can still venture to describe all three species as follows.

Dendrobium moschatum.

Caulibus teretibus pendulis foliis linearibus obtusis—racemis lateralibus laxis 5-8 floris—sepalis lanceolatis acutis patentissimis, petalis rhomboidro-ovatis obtusis latioribus,—labello cochleariformi obtusissimo extus villosus.

Flores $2\frac{1}{2}$ -3 unc: *aurantiaci*. Labellum *eiusdem coloris*, intus utriusque versus basin maculis duabus *coccineis*-venis quinque cristato fimbriatis.—Columna et anthera *luteo virides*

This species is called by Lindley "superb"—which term I consider an exaggeration. It may be called simply a *fine* species.—

Dendrobium calceolaria.

Caulibus teretibus pendulis,—foliis linearibus obtusis racemis lateralibus laxis 5-8 floris—sepalis oblongis obtusis patentissimis, petalis oblongo-ovatis obtusis multo-latioribus—labello cochleariformi obtusissimo abrupte inflexo villosissimo.

Flores *rosei*, magnitudine *D. moschati*, vasus columnum *flavescentes*—labellum *lutescens*, intus maculis duabus *am- folis atropurpureis*, venis cristato fimbriatis.—Columna et anthera *atropurpureæ*.—

There is little, if *any thing*, else but colour to distinguish these two plants. Out of flower it is impossible to tell one from the other.—I find in *both* the raised and cristate veins in the labellum. In *D. calceolaria* the segments of the Perianth (outer and inner) are much broader than in *D. moschatum*, and the labellum is *more* saccate and more villous.—The anther in *D. moschatum* I find invariably green or greenish yellow, but sometimes the column is *slightly* stained in front.

with purple. Both *D. moschatum* and *D. calceolaria* smell strongly of *Rhubarb* and *Magnesia*. *D. Dalhousianum* does not.

Dendrobium Dalhousianum.—

Caulibus teretibus pendulis *lineis purpureis striatis*—foliis linearibus obtusis—racemis lateralibus 5-8 floris laxis—sepalis oblongis obtusis; petalis oblongo-ovatis obtusis latioribus, labello *cymbæformi margine reflexo villosa*.

Flores speciosissimi pallidi flavi, nunc roseo colore dilati tincti, 4 unci lati; labellum ejusdem coloris, intus maculis duabus amplis atropurpureis. Columna et anthera atropurpureæ. Species major et robustior antecedentibus.

D. Dalhousianum, besides its much larger size both in the flower and in the stem, and its somewhat different colour, a rich creamy (yet golden) yellow, now and then only tinged with pink near the extremities of the sepals and petals, is always readily to be distinguished from the two above mentioned species by the *rich purple longitudinal streaks of colour on the stem*. The stems of the other two have not these and are *stippled* all over the young stems with minute green and purple dots.

When in flower, another mark is in the labellum, which is not nearly so saccate as the others and has its central margin turned outward.

Monthly Proceedings of the Society.

(Wednesday, the 20th of July 1864.)

BABOO PEARY CHAND MITTRA, Vice-President, *in the Chair.*

The proceedings of the last Monthly Meeting were read and confirmed.

The following Gentlemen were elected Members —

The Secretary of the Agricultural and Horticultural Society, Bhanguipore, Messrs. Rivers Thompson, Thomas Baker, A. Blandford, E. J. Churcher, J. M. Campbell, E. Meakin, and Lieutenant R. C. Beavan.

The names of the following Gentlemen were submitted as candidates for election :—

Thomas T. Smith, Esq., Kurchucka Factory, Rajshahye,—proposed by Mr. H. Deverell, seconded by the Secretary.

F. E. Moore, Esq., Personal Assistant to Financial Commissioner of the Punjab,—proposed by the Secretary, seconded by Mr. W. Stalkutt.

William Pigott, Esq., Calcutta,—proposed by Mr. T. H. Mosley, seconded by Mr. John Wienholt.

G. N. Barlow, Esq., c. s., Pooree,—proposed by Mr. J. W. Armstrong, seconded by the Secretary.

Captain F. H. Macnaghten, Stud Department, Buxar,—proposed by the Secretary, seconded by Mr. J. A. Crawford.

T. Chrestien, Esq., Mangulpore,—proposed by Mr. C. M. Wilson, seconded by the Secretary.

E. E. Lewis, Esq., c. s., Ranpore Baulcah,—proposed by Baboo P. C. Mittra, seconded by Mr. Crawford.

The following presentations were announced —

1.—Memoirs of the Geological Survey of India, Vol. III., Part II., and Vol. IV., Part II. From the Government of Bengal.

2.—A Geographical, Statistical and General Report on the District of Hazareebaugh, by Captain G. H. Thomson. From the Government of Bengal.

3.—The Report of the Committee of the Bengal Chamber of Commerce, from November 1863 to April 1864. From the Chamber.

4.—A fine large Plant of *Mantha piperita*. From Mr. Joseph Agabeg.

5.—Seven samples of Tobacco from the Prome District and a quantity of Seed. From Major R. W. Ripley.

6.—Samples of Tobacco and Cotton from the Rangpo Jail Garden: From Captain E. B. Sladen, Magistrate of Rangpo.

7.—Samples of Tobacco raised at Rangoon from Rungpore seed. From Captain E. Fowle.

(Full particulars respecting the above will be found in the body of the Proceedings.)

On the recommendation of the Council, Mr. A. S. Sawers was elected a Member of their body in the room of the late Mr. C. B. Stewart.

The Gardener submitted a second Report on the collection of Rose Plants forwarded by Messrs. James Carter & Co. in the early part of the year. About one-half the number have survived the hot season.

The Gardener also submitted a list of the surplus stock of Ornamental Plants and Fruit grafts that may be made available to the public at certain fixed rates during the present season.

Agreed that these be advertised for sale.

COTTON FROM RANGOON.

Read the following minutes of a Section of the Committee on the sample of Cotton raised in the Rangoon Experimental Garden from New Orleans seed, acclimatized at Lucknow and submitted at the Meeting in May last by Mr. Leeds, Officiating Conservator of Forests, British Burmah :—

"A very beautiful specimen of Cotton raised from acclimatized seed, the bolls being unusually fine, color somewhat superior, and length of staple fully equal to the most useful description of American growth, known as 'muddling' Orleans fibre of fair strength. Present value in the Home Market, according to last advices, about 27s. per lb." T. H. MOSLEY.

"I coincide in Mr. Mosley's opinion as well as in his valuation. It appears the New Orleans Cotton will be largely cultivated in Burmah and in Tenasserim. We have had already supplies sent up from Moulmein, lately brought or rather consigned to a Native, in 40 to 50 bales at a time, and altogether within the last three or four months above 250 bales or equal to 1,000 maunds. I beg to forward a sample for the inspection of Members and recommend that this should be brought to the notice of Mr. Leeds, and arrangements should be made through Messrs. Mosley and Hurst, Agents, Manchester Cotton Supply Association, for importing and delivering to applicants at cost price such quantities of New Orleans Cotton seed as they may apply for to those gentlemen direct, and have their applications registered before 1st November 1864. I am convinced that portions both of Burmah and Tenasserim are capable of producing any quantity of New Orleans Cotton, if timely information and aid be given to the settlers in those countries. I forgot to add that the said Cotton was sold here as high as Rs. 54 per Bazar Maund." JOSEPH AGABEG.

Agreed that Mr. Agabeg's suggestion be adopted. It was mentioned that 150 more bales of Cotton of an equally good description as that submitted by Mr. Agabeg, have been recently imported from Moulmein.

TOBACCO AND COTTON FROM BRITISH BURMAH.

Read the following letters from Captain E. B. Sladen, Magistrate of Rangoon, Captain E. Fowle of Rangoon, and Major F. W. Ripley, Deputy Commissioner at Prome, respecting the samples of Tobacco and Cotton already referred to:—

Captain Sladen writes:—"I have the pleasure to forward for your inspection 18 lbs. of Tobacco and 1 lb. Cotton, grown in the Rangoon Jail Garden, and chiefly within the precincts of the Rangoon Jail enclosure.

"The growth of Tobacco being experimental only in this Division of British Burmah, it will be both interesting and important to be favored with the opinion of your Committee upon the specimens now forwarded.

"The Tobacco was raised from Rungpore seed sown in the month of November, the crop having been gathered during the months of March and April. The plants, though they appeared generally to flourish, shot up, it was considered, almost too rapidly, and it was found expedient to have recourse to, what I believe may be called, a native remedy, of nipping off the uppermost shoot, and passing thin strips of bamboo a few inches down the central stalk.

"This apparently rude interference with the vitality of the plant had certainly the desired effect of causing an expansion of the leaves already formed, whilst it effectually stayed the upward growth of the plant.

"The Tobacco is forwarded to you in the original state in which it was first picked, without having undergone any preparation whatever, though it is to be feared that the present damp weather may have caused it to lose some of its pungency.

"The soil upon which it was grown is of that loose ruddy alluvial kind which prevails throughout the delta of the Irrawaddy, so that if the present specimen is deemed in any measure to be a success, a vast field may be said to be open for extensive Tobacco cultivation throughout the Province.

"As regards the Cotton, a small quantity only (some 300 plants) was raised from Egyptian seed sown in the month of May 1863. The plants all grew well and flowered in less than three months, each plant bearing an average of 15 pods. During the dry season some 10 per cent of the plants sown seemed to wither from exposure to excessive heat, but many have since shot up again from the root since the setting in of the present monsoon. Those plants which could be watered, and in part sheltered from the sun, are at present in a very thriving state, and many of them are more than six feet in height.

"The small portion of Cotton now forwarded has merely been freed from the seed without apparent injury to the fibre. This circumstance, it is hoped, will not prevent your passing an opinion on its qualities as an article of commerce.

"I may mention that the seed obtained from last year's crop has again been sown, and the young plants obtained from it are at present growing well."

Captain Fowle observes:—"The Tobacco forwarded by me was raised from different species of Rungpore seed on my plantation close to Rangoon. The soil

is of a ferruginous character, and in the cultivation and curing I have followed as closely as practicable the directions laid down for this description of Tobacco, as published in the Horticultural Society's Journal.

"The present being my first experiment of the kind, it hardly affords sufficient data to form an estimate of its remunerativeness in a commercial point of view, but has amply satisfied me that the soil and climate of this locality are suitable for the successful cultivation of this kind of crop.

"I am happy also to state that several of my friends have been equally successful with seed of this description distributed by myself last season."

Major Ripley thus alludes to his samples:—"I have sent by this opportunity a basket containing samples of Tobacco from different parts of this district.

"No. 1, called Tsaynek Kyee, grown on a Chur near the Town of Shoedoung Myoma.

"No. 2, Myouk Toin, from the same place.

"No. 3, Meetsoung, ditto.

"No. 1a, a sample from the banks of the Irrawaddy, near Nyoungbintseik, being produce of seed received from the Koladyne River, Akyah District, called Nabanbway.

"No. 2a, from same place, also produce of seed from the Koladyne, called sometimes Myouktuin and sometimes Goktoh.

"No. 1b, produce of Sandoway seed on grown banks of Irrawaddy, near the Town of Padoung.

"No. 2b, of acclimated Havannah Tobacco seed, received from Sandoway, grown at the same place.

"I have also put a sample of seed of each of the five first kinds.

"I hope these will reach safely, and be in good order. By next steamer I will send samples of the soil where the specimens were grown."

All these samples were referred to the Tobacco and Cotton Committees for report.

AGRICULTURAL STATISTICS.

Read the following letter from the President, Officiating Statistical Committee:—

"Referring to the proceedings of the Government of India in the Financial Department, dated 6th June 1862, (published at page 198 of the Supplement to the *Calcutta Gazette* of June 14th 1862,) I beg to lay before the Council of your Society two copies of a Memorandum which records the proceedings of a Meeting held two years ago at the house of Mr. Erskine, late President of the Officiating Statistical Committee.

"2. On reference to the Government Resolution, it will be seen that our Committee is not intended to take up Scientific Statistics, which are to be left to 'self-managed and voluntary Societies.' If the Agricultural and Horticultural Society is prepared to co-operate with our Committee, and will engage itself in obtaining Agricultural Statistics, it may reckon I think on the same amount of

aid and encouragement which the Resolution has promised to the Statistical Society, in the event of its being formed."

The above letter was submitted by the Council with the recommendation for the appointment of a Committee; whereupon it was proposed by Baboo P. C. Mitra, seconded by Mr. J. A. Crawford, and resolved—That this Meeting, before adopting the recommendation of the Council for the appointment of a Committee, beg the Council to consider and report on the mode in which statistical enquiries can be instituted by that Committee.

A Report was submitted by the Deputy Agent, East Indian Railway Company, in respect to a number of Mahogany trees which were supplied from the Society's Garden in 1856 to plant along the line. As the report in question accounts for ten only, and that at stations close to Calcutta, it was agreed that another letter be addressed to the Agent for particulars regarding the remaining ninety trees, which were probably planted at stations higher up on the line.

For the above communications, the best thanks of the Society were accorded.

(Wednesday, the 17th of August 1864.)

BABOO PEARY CHAND MITTRA, Vice-President, in the Chair.

The proceedings of the last Monthly Meeting were read and confirmed.

The following Gentlemen were elected members:—Messrs. Thomas T. Smith, F. E. Moore, Wm. Pigott, G. N. Barlow, T. Chrestien, E. E. Lewis, and Captain T. H. Macnaghten.

The names of the following Gentlemen were submitted as candidates for election:—

Major John Ashourner, Bombay Staff Corps, and Deputy Commissioner of Chindwarah,—proposed by Colonel R. Snow, seconded by Mr. J. A. Crawford.

J. Taylor, Esq., Stud Department, Hissar,—proposed by the Secretary, seconded by Mr. W. Haworth.

Major G. Delane, Commanding G. G.'s Body Guard,—proposed by Mr. Grote, seconded by Baboo P. C. Mitra.

F. Wyman, Esq., Calcutta,—proposed by Mr. John Stalkartt, seconded by the Secretary.

Manager of the Bengal Tea Company, Cachar,—proposed by Mr. H. Knowles, seconded by Mr. A. Stuart.

C. T. Davis, Esq., Solicitor, Calcutta,—proposed by Mr. E. G. Haddan, seconded by Mr. John Bean.

John Colin Campbell, Esq., Calcutta,—proposed by Mr. W. G. Rose, seconded by the Secretary.

T. M. Payne, Esq., Calcutta,—proposed by Captain W. T. Salmon, seconded by Dr. J. B. Barry.

The following presentations were announced :—

- 1.—Selections from the Records of Government of India, P. W. D., No. XLI.
- 2.—Selections from the Records of Government, N. W. P., Part 40.
- 3.—Report of the Commissioners appointed to enquire into the sanitary state of the Army in India. The above presented by the Government of Bengal.
- 4.—Potatoes of a fine description from Australian stock, presented by Mr. H. J. Butler. (Forwarded to Colonel Haughton at Cooch Behar.)
- 5.—A quantity of Rungpore Tobacco Seed, presented by Mr. A. D. Rehling. (Half forwarded to Colonel Phayre at Rangoon.)
- 6.—Samples of Tobacco raised at Jungypore from Havanna seed, presented by Mr. A. N. Stewart. (Referred to the Committee for report.)
- 7.—Some very fine Cocoanuts raised in Calcutta from Burmah stock, presented by Mr. C. Whittenbaker.

PROPOSAL FOR A PUBLIC GARDEN.

READ the following correspondence based on the Resolution passed at the Monthly General Meeting held on the 21st January last :—

TO THE SECRETARY OF THE GOVERNMENT OF BENGAL.

SIR,

I am directed by the Council of the Agricultural and Horticultural Society to solicit the favor of your laying before His Honor the Lieutenant-Governor of Bengal the subject-matter of this communication.

2. In October 1826, the Society applied to Government for the use of a spot of ground in the vicinity of Calcutta for the purposes of a Garden.

3. In the early part of 1827, the Government gave the Society permission to occupy Mr. Palmer's Garden of thirty beegahs at Allipore at the commencement of the Budge-Budge Road, paying the rent for the same (Sicca Rupees 100 per mensem), and authorized the lease of such further quantity of ground adjoining as could be procured for Rupees 30 more. Thirty Beegahs more were accordingly procured.

4. In May 1827, the Garden was taken possession of and retained till the middle of 1834, when it was abandoned for want of funds, the number of Members being seriously diminished owing principally to the calamitous commercial events of the previous year. The Government, however, consented to continue, as a monthly allowance, the amount (Sicca Rupees 130) previously granted.

5. In the year 1835, at the solicitation of the Society, the then Acting Superintendent of the Botanic Garden, Mr. J. W. Grant, consented, with the sanction of Government, to grant a plot of ground on the northern side of the Garden, as a Nursery for the reception and propagation of foreign varieties of sugarcane and cotton. But it was soon found that the area of six beegahs so granted was inadequate to meet the steadily increasing demands from all parts of the country from the stock thus raised. Application was accordingly made for an extension

of ground, and this was accorded. This additional ground having been also found in the course of time insufficient for the continued pressure on the Society's means of supply, a third application was made and acceded to, until from a small Nursery of six beegahs the Garden has extended to about seventy-five beegahs.

6. As the ground above referred to was previously untilled, the Society have been obliged to incur considerable expense in cultivating it: they have, moreover, disbursed large sums from time to time in roads and buildings. The total sum thus expended from the commencement till the close of 1863 amounts to Rupees 1,04,450. The present monthly expenditure is about Rupees 500.

7. During the period of rather more than 25 years that this spot of ground has been in the occupancy of the Society, large quantities of sugar-cane, guinea grass, tapioca, arrowroot, rheca, fruit trees of many kinds, and other useful plants, have been distributed throughout the country. During later years, the Society have combined the ornamental with the useful, and disseminated many thousands of flower plants and large quantities of seeds to their Members. It has, consequently, proved a source of usefulness, and thus fulfilled the objects proposed in its original formation and gradual extension.

8. Dr. Anderson, the present Superintendent of the Botanic Garden, has recently brought to the notice of the Council his intention of applying to Government for a resumption of the ground above alluded to, it being much required to enable him to carry out more efficiently several changes he is now making in connection with the extension of certain families of plants, and the general arrangements of the Garden.

9. Foreseeing the probability of such application being made, the Council, some months ago, appointed a Sub-Committee of their body for the purpose of enquiring and reporting, with reference to the financial position of the Society, and localities available, what arrangements should be made for having a Garden on this side of the river. The Committee having duly considered the subject and made various enquiries in respect to sites, came to the following resolutions:—

“First.—That the Committee are of opinion that the present financial position of the Agricultural and Horticultural Society does not admit of its purchasing ground on the Calcutta side of the river, on any site which would be at all eligible for their Nursery Garden.

“Second.—That the Committee, after enquiry for a site which would be centrally situated, and at the same time suitable for their purpose, have not succeeded in finding one that would be in every respect desirable, but in the event of funds becoming available, they beg to indicate the property of the Kidderpore Orphan Asylum as an available site, which might suit the requirements of the Society.

“Third.—That it be therefore recommended to the Council to address the Government, soliciting them to present to the public, for the purposes of a public Garden, such portion of the Kidderpore property as would be suitable for that purpose, and proposing that in the event of the same being granted, the Agricultural and Horticultural Society would remove their Nursery Garden to a portion of the

ground and undertake the management of the entire establishment, provided that the expense to be incurred by the Society in such management do not exceed that now incurred in the maintenance of their Nursery Garden."

10. These resolutions having been submitted by the Council at a Monthly General Meeting of the Society held on the 21st of January, it was unanimously resolved—

"That this Meeting cordially adopt the Report of the Council, recommending that Government be addressed on the subject of a Public Garden."

11. I am accordingly directed, in bringing the above to your notice, to solicit that His Honor the Lieutenant-Governor will take the subject of this communication into consideration, and the Society venture to hope that he will be pleased to comply with the recommendation contained in the last resolution.

12. In conclusion, the Council would beg to bring to His Honor's notice the fact that the Government of Bombay have recently granted to the Agricultural and Horticultural Society of that Presidency nearly £20,000 worth of land, besides an annual grant for establishment for their Garden, and free water from the Municipality.*

Further, that the Government of Bengal have acceded to an application from the Superintendent of Darjeeling, dated 18th November 1863, for a piece of land, consisting of 97 acres, for the use of an Agri-Horticultural Society in process of formation at that Station. The letter of Sir C. Trevelyan to Mr. Schaleh, suggesting a People's Park in the neighbourhood of Scaldah, may likewise be cited in further support of the application above referred to.

I have, &c.,

A. H. BLECHYNDEN,
Secretary.

Calcutta, 3rd February 1864.

No. 181.

Office Memorandum, Military Department, the 8th of July 1864.

In returning the papers received with the docket from the Home Department, No. 2327, dated 31st March 1864, the undersigned has the honor to inform the Secretary to the Government of India in that Department, that the Military Orphan premises alluded to have not yet been made over to Government, and that the transfer awaits the orders of Her Majesty's Secretary of State for India, to whom the question was submitted some time since.

(Signed) H. K. BURNE, *Lieut-Colonel,*
Offg. Secretary to the Government of India.

TO THE SECRETARY TO THE GOVERNMENT OF INDIA,

HOME DEPARTMENT.

* *First Annual Report of the Agricultural and Horticultural Society of Western India, dated 1st January 1863.*

No. 4076.

Copy forwarded to the Government of Bengal, with reference to letter therefrom, No. 972, dated the 26th of February, and with the intimation that a further report from the Military Department will be awaited.

<p>FORT WILLIAM; Home Department, The 15th July 1864.</p>	<p>By order, (Signed) A. HOWELL, Offg. Under-Secy. to the Govt. of India.</p>
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No. 3102.

Copy forwarded to the Secretary to the Agricultural and Horticultural Society for information, with reference to his letter dated 3rd February 1864.

<p>FORT WILLIAM, The 26th July 1864.</p>	<p>By order of the Lieutenant-Governor of Bengal, S. C. BATLEY, Junior Secretary to the Government of Bengal.</p>
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Ordered that this correspondence be published in the proceedings of this day's Meeting.

IMPROVEMENT OF THE BREED OF NATIVE CATTLE.

Read the following letter from the Government of Bengal, dated 20th July 1864, in reference to the Report submitted at the Monthly Meeting in March:—

"I am directed to acknowledge the receipt of your letter, dated the 29th March last, and to convey to you the thanks of the Lieutenant-Governor for the Report submitted by the Society on the best means of improving the breed of Bengal Cattle.

"2. A copy of the Society's Report has been forwarded to the Government of India, in the Military Department, with reference to the recommendation for Local and Central Cattle-Shows to be held annually, which the Lieutenant-Governor offered when reporting on the late Agricultural Exhibition.

"3. The whole of the correspondence on the subject will be published in the *Calcutta Gazette Supplement*, and copies of it will also be forwarded to the different Commissioners of Divisions for distribution among the Zemindars and other persons likely to read them, and to profit by the information they contain. But as the Lieutenant-Governor desires that the papers referred to in the 7th para. of the Committee's Report, received with your letter under reply, should be also published and circulated to the Commissioners, I am to request that the Society will be so good as to forward them to this office at as early a date as practicable, in order that they may be printed with the rest of the correspondence in this office.

"4. The Board of Revenue will be requested to consider the subject, and to report what further practical measures can be taken by Government, with a view to give effect to the recommendations of the Society.

"5. Adverting to the 2nd para. of my letter No. 1304, of the 14th March last, I am desired again to urge on the Society the Lieutenant-Governor's wish that

they should undertake the preparation of a brief Manual, to be translated into the native languages and widely circulated, containing practical suggestions to Zemindars, Ryots, and all classes of Agriculturists, for the more careful breeding, rearing and pasturage of Cattle."

On reference to the last paragraph of the above letter, the Secretary explained that some delay had unavoidably occurred in consequence of the temporary absence from the Presidency of more than one Member of the Special Committee; but the Manual is now in hand and would be shortly submitted.

COTTON SEED AND MACHINERY.

READ the following letter from Messrs. Mosely and Hurst, Honorary Agents, Manchester Cotton Supply Association, dated 3rd August 1864, in acknowledgment of the Resolution passed at the last Meeting:—

"We have to acknowledge the receipt of your letter of this date, accompanying copy of a minute by Mr. Joseph Agabeg, with reference to the supply of New Orleans Cotton seed for Burmah, and requesting us to inform you if we are agreeable to take action in the matter, in connection with the Association we represent.

"Fully concurring in the opinion expressed by Mr. Agabeg in his said Minute, we shall have much pleasure in meeting, as far as practicable, the views of your Society, and although there would appear to be great difficulty in obtaining American seed at present, owing to the war in the States, we think the Cotton Supply Association will be able to provide a moderate quantity for distribution at cost price. Supplies *via* the Cape, we believe, can be laid down here at about Rs. 16 to Rs. 18 per Bazar Maund, and we shall be glad to register all applications, accompanied by a remittance, received on or before the 1st November next. As you are aware, we lately received a small supply of New Orleans seed by the Overland route, and are distributing same at cost price, say Rs. 36 per Bazar Maund, about 20 Maunds being now available to cultivators."

The best thanks of the Society were given to Messrs. Mosely and Hurst for their ready compliance with the above request.

The Secretary intimated that he had communicated fully both with Colonel Phayre, the Chief Commissioner of British Burmah, and the Conservator of Forests, in respect to the above, and had requested their co-operation.

Read extract of a letter from Mr. S. H. Robinson, dated Manchester, 8th July, regarding a Roller Cotton Gin:—

"Platt Brothers and Co. are making my Spinning Machinery, and in visiting their manufactory at Oldham, I have been struck by the extraordinary activity in their department for making Cotton Gins. They tell me they are turning out at the rate of 80 Gins per diem, and have orders to keep them at work for some months. The kind principally in demand is the double-acting Macarthy, which, with some recent improvements introduced by them, appears to be the most successful machine yet made. There are two sizes, one with 40-inch long cylinders to work by power which turn out 250 lbs. per day of clean cotton: the other with 12-inch cylinders

to work by hand, which turns out 8lbs. per hour, say 1 Maund per day these are for short staple Indian Cottons like we get in Calcutta. I saw them at work and they certainly do the business more effectively than any Roller Gins I have yet seen, and if you have not already got one for the Agricultural and Horticultural Society, I think you should get one as a sample to show the latest improvement in this direction, to the many applicants you have for an effective and inexpensive Gin. The 40-inch size costs only £13-10 in England, the Hand Gin much less.

"Macdonald's, which costs Rs. 250, if I remember right, turns out only 80lbs per day, and is a much more cumbersome affair. Some of the mills here are working on Bengal Cotton alone, and I find there is not the least difficulty now in adapting the machinery to it, so it is clear I shall have no difficulty on that score to contend with."

The Secretary brought to the notice of the Meeting that he had also, when in England, called attention to the above Machine (see proceedings for December 1862,) but had sent out the Forbes and Platt's Roller Churka Gin with feeder, in the place of the double-action Macarthy, as the latter, as then made, was more suitable for long staple Cotton, whereas the former is recommended for East India or any other description of short staple Cotton.

It was agreed, on the suggestion of the Council, to delay procuring one of the machines recommended by Mr. Robinson till the Forbes and Platt's Roller Churka and others, rather recently imported, had been fully tested.

NEW GRANADA PADDY.

READ the following extract of a letter from E. F. Lautour, Esq., dated Bhaugulpore, 3rd August:—

"I should very much like to see the Society importing the different kinds of Rice grown in South America into this country. The Rice of New Granada, to wit, is well adapted to this country, as I once tried it in Chittagong and found it grew luxuriantly without irrigation. I think now we are introducing Agricultural Exhibitions into India, the Rice of South America would have a fair trial if introduced into this country. This is a suggestion which I think will meet with your Society's approval: at any rate, it is worth experimenting on."

In connection with the above, the Secretary drew the attention of the Meeting to various trials made with this description of Paddy during the years 1852 and 1853 at Darjeeling, Chota Nagpore, Sylhet and the Punjaub, as recorded in the Journal, Volume VIII., pp. 81 and 178. He also placed on the table certain specimens of the grain on the stalk, which were contributed by Mr. Haworth as the produce of his garden at Cossipore in 1853, and which, from their present excellent state of preservation, would seem, unlike most other descriptions of Paddy, to possess the property of resisting the attack of weevil.

Agreed that steps be taken to procure another supply of New Granada Paddy. Letters were also read—

From Messrs. Russell and Sturgis of Manilla, dated 21st May, respecting an application made to them for Tobacco-seed to meet the request of Colonel

Houghton, who expressed his desire to introduce this description into Cooch Behar Messrs. Russell and Sturgis intimate their readiness to endeavour to procure the seed, but have little hope of succeeding, "as the Government watch the plantations (which are all at a great distance) very jealously, and the exportation of seed is strictly prohibited. We fancy from the bad result of the trials of seed that we have been able to obtain in very small quantity, that its germinating property is destroyed purposely before it reaches Manilla."

From Colonel J. C. Houghton, Cooch Behar, dated 8th August, of which the following is an extract :—

"I beg to thank you for the trouble taken in meeting my wishes as expressed in yours of 28th Ultimo. The potatoes arrived all safe, and I have them carefully laid in sand awaiting the season when they may be planted. I well remember 32 years ago meeting with the same jealousy of the Spanish in Cuba, and am not surprised at what your correspondents say. I am not, however, so anxious to get seed as I was. My belief is that more depends on cultivation than mere seed. The tobacco here is good, but until some European comes into the country who will show the people the best mode of cultivating, curing and packing it, I fear all the good seed will be of no avail. Probably it would pay a practical man to settle down and take up tobacco as others have done indigo and tea."

From Messrs. James Carter & Co., enclosing Bill of Lading for 40 cases of Peas and Beans shipped per *Robert Lee*.

(Monday, the 19th September 1864.)

BABOO PEARY CHAND MITTRA, Vice-President, in the Chair.

The proceedings of the last Monthly Meeting were read and confirmed.

The following gentlemen proposed at the last Meeting were elected Members :—

Major John Ashburner, Major G. Delane, The Manager of the Bengal Tea Company, Cachar, Messrs. J. Taylor, F. Wyman, C. T. Davis, J. C. Campbell and T. M. Payne.

The names of the following gentlemen were submitted as candidates for election :—

Dr. J. W. Mountjoy, Akyab,—proposed by the Secretary, seconded by Mr. J. A. Crawford.

Baboo Hurro Chunder Ghose, Judge, Small Cause Court,—proposed by Baboo P. C. Mitra, seconded by Baboo S. C. Deb.

Dr. W. R. Hooper, Officiating Superintendent, Central Prisons, Allahabad,—proposed by Brigadier General D. Rainier, seconded by the Secretary.

Captain W. S. Millard, Superintendent, Calcutta Docking Company,—proposed by Mr. Joseph AgaBeg, seconded by Mr. W. Stalkart.

Lieutenant-Colonel R. Campbell, H. M.'s Bengal Staff, Cawnpore,—proposed by the Secretary, seconded by Mr. C. E. Creswell.

D. W. Taylor, Esq., Grantee, Oude,—proposed by Dr. E. W. Bonavia, seconded by Major T. H. Chamberlain.

Dr. Foster Maynard, Rangoon,—proposed by the Secretary, seconded by Mr. Crawford.

E. J. French, Esq., Tea Planter, Jorahaut,—proposed by Mr. H. G. French, seconded by Mr. W. Stalkart.

W. R. Chardon, Esq., Doudnuggur, Shahabad,—proposed by Mr. Creswell, seconded by Mr. Crawford.

Lieutenant E. M. Woodcock, District Superintendent of Police, Seetapore, Oude,—proposed by the Secretary, seconded by Mr. Crawford.

E. G. Buskin, Esq., Calcutta,—proposed by Mr. Creswell, seconded by the Secretary.

The following presentations were announced :—

1.—Selections from Records, Government of India, P. W. Department, No. 42. Correspondence relating to the deterioration of lands from the presence in the soil of *Rh.* Presented by the Government of Bengal.

2.—A Collection of Treaties relating to India and neighbouring Countries. Vol. IV. Presented by the Government of India.

3.—The Madras Journal of Literature and Science, No. 1, Third Series. Presented by the Madras Literary Society.

4.—Journal of the Asiatic Society of Bengal, No. 3 of 1864. Presented by the Society.

5.—Memoirs of the Geological Survey of India. Palæontologia Indica, 3-4. Presented by the Government of Bengal.

6.—A small quantity of seed of New Zealand Flax (*Phormium tenax*) Presented by A. Grote, Esq.

7.—Six samples of the soil in which the various kinds of Tobacco from British Burmah, submitted at the July Meeting, were raised. Presented by Major F. W. Ripley.

It was agreed that Mr. Medlicott be requested to favor the Society with an analysis of these soils.

8.—Five samples of Cotton raised at Rangoon from Pernambuco, Egyptian and Indigenous Seed. Presented by E. Fowle, Esq. (Referred to the Committee.)

9.—Two small specimens of raw Silk from Lieutenant Marsh at Lucknow. Presented by A. Grote, Esq.

Mr. W. G. Rose, to whom these small skeins were referred, reports as follows :—

“They have been evidently reeled from the annual cocoon, which is the same as the Italian cocoon, and the best silk made is from this cocoon. The samples are well reeled, but the thread is a great deal too stout. In reeling this cocoon the thread ought to be from the fibre of five or six cocoons, but the samples must have been reeled from ten to twelve.”

Proceedings of the Society.

10. Three specimens of Tussur Raw Silk, reeled by Dr. Amesbury. Presented by Lieutenant R. C. Beavan.

Mr. E. G. Buskin reports to the following effect on these samples :—

“The cocoon in its original state as per the white specimen, No. 3, is of very strong fibre and very elastic, and the yield (if this is from one cocoon) is very large; if this silk could be reeled with a thread of six to eight cocoons, with plenty of twist, and a skein like the usual Benigal skeins, it would doubtless be a desirable and saleable article in this market. The two colored specimens, Nos. 1 and 2, are much weaker and more brittle. It is important that the silk should be brought to market in its original color and not dyed as this is.”

PERIODIC FLOWERING OF THE BAMBOO.

Read the following correspondence on the above subject :—

TO THE SECRETARY, AGRICULTURAL AND HORTICULTURAL SOCIETY.

General.

SIR,

WITH reference to the accompanying copy* of a correspondence, I am directed to request that the Agricultural and Horticultural Society will be so good as to favor the Lieutenant-Governor with any information that they may have or may be able to collect regarding the general seeding of the Bamboo.

I have, &c.

S. C. BAYLEY,

Junior Secretary to the Government of Bengal.

Fort William, the 10th August 1864.

FROM the OFFICIATING UNDER-SECRETARY to the GOVERNMENT OF BOMBAY, to the SECRETARY to the GOVERNMENT OF BENGAL.—(No. 2274A, dated the 17th June 1864.)

SIR,

I AM directed by His Excellency the Governor in Council to forward herewith copy of a letter addressed by the Collector of Canara to the Revenue Commissioner, Southern Division, and to request that this Government may be favored with any information the Government of Bengal may possess relative to the seeding of the Bamboo, and whether it is connected, as far as they are aware, with the prevalence of fever or otherwise.

Extract from the Proceedings of the Government of Bombay, in the Revenue Department, No. 2274, dated the 17th June 1864.

READ the following papers :—

Letter from Mr. M. J. SHAW STEWART, Collector of Canara, to Mr. W. HART, Revenue Commissioner, Southern Division.—(No. 874, dated the 16th April 1864.)

I HAVE the honor to report that a very large number of people have migrated from the Dharwar and Belgaum Districts to this (Soopta) Talook for the purpose of collecting the Bamboo seeds, which are very plentiful this year. They come from Nepanee, Kittoor, Nurgoon, and the Hooblee Talook in small parties, and remain for ten days or a fortnight, during which time they collect as much seed as the whole party can carry away. It is estimated that about 50,000 persons have in this manner visited the Soopa Jungles during the present season, including inhabitants of Canara as well as those belonging to other Districts. I am glad to be able to report that no disturbance whatever has been caused by these persons, who have conducted themselves in a peaceable and orderly manner.

2. I believe that the supply of grain thus afforded by the bounty of nature has proved a providential benefit to the poorer classes during the present scarcity of food. It is calculated that each party takes away enough for home consumption during the monsoon months, and that there is some for sale also.

3. Both the large Bamboos (Bidurguloo) and the medium-sized or common Bamboo (Shihoo) have seeded in many parts of the Soopa Talook this year. The seed of the large Bamboo is like oats in shape and taste, and is preferred to the other as being more easily prepared and more digestible. The supply of seed from the large Bamboo is now almost over for the season, and the people are collecting the seeds of the smaller kind.

4. I am informed that it is expected that the seeding will be more general next year than it has been during the present season.

5. I am unable to give much information regarding the supposed periodical seeding of these gigantic grasses. The Natives all appear to think that a general seeding takes place at periods variously estimated at from thirty to sixty years. There is no doubt that partial seeding takes place irrespectively of these periods, probably more or less every year. I frequently observed Bamboos in seed and young plants growing during the years 1850-55. But there is no doubt that the seeding in the present season is quite exceptional. The appearance of the forests is much altered by the effect of the novel crop with which the Bamboos are covered.

6. It is well known that all the Bamboos that seed die during the same year. The seeding of this and the following season will therefore cause a great diminution of the number of these useful plants.

7. You will doubtless remember that the prevalence of fever in Canara has been attributed to the great increase of Bamboo jungles. If this theory be correct, we may expect that the fever will now decrease. In point of fact a very considerable decrease has been observed since the last monsoon. It would be interest-

Such as Coimbatore, Coorg, Salem, and Mysore.

ing to know if the Bamboos have seeded generally in the other Districts where fever has been prevalent of late years, and whether it has been followed by a decrease of the epidemic.

Proceedings of the Society.

8. With reference to the supposed periodicity of the Bamboo seeding, I hope it will not be considered out of place to note that about sixty years appear to have elapsed since this District was scourged by an epidemic fever similar to that which has been prevalent for the last few years. Dr. Buchanan, who was commissioned in 1808 to visit the countries recently conquered from the Sultan Tippoo, mentions in his Report that the northern parts of this Collectorate in 1806-07, suffered greatly from fever, by which some villages were almost depopulated. Since that time, so far as I can ascertain, Canara has been considered a remarkably healthy and salubrious District.

Memorandum from Mr. W. HART, Revenue Commissioner, Southern Division, to Government.—(No. 1718, dated the 18th May 1864.)

SUBMITTED for the information of Government.

2. The Revenue Commissioner begs to add that he has, with the assistance of the Collectors of Canara and Belgaum, been able to obtain upwards of two cart-loads of Bamboo seed, which he proposes to distribute at Poona to any persons wishing to sow it.

RESOLUTION.—Copies of this letter should be forwarded to the Governments of Madras and Bengal, with a request that they will favor this Government with any information they may possess relative to the seeding of the Bamboo, and whether it is connected, as far as they are aware, with the prevalence of fever or otherwise.

2. The Conservator of Forests and the Collectors in whose Districts the Bamboo abound, should also be requested to procure any information they can on the above points.

3. The seed should be distributed.

No. 1352T.

FORWARDED, in original, to Dr. Anderson, Superintendent of the Botanical Gardens, with a request that he will favor the Lieutenant-Governor with his opinion on the subject, and any information he may possess.

The papers to be returned.

From T. ANDERSON, Esq., M. D., Superintendent of the Botanical Gardens, to the Secretary to the Government of Bengal.—(No. 34, dated Darjeeling, the 28th July 1864.)

SIR,

IN reply to your endorsement No. 1352T* of the 17th Instant, I have the

honor to inform you that I possess little information about the periodic seeding of Bamboos. In Bengal there are no extensive tracts covered with Bamboos as

in Western India, but it is generally believed that even where Bamboos have been planted, as for example near villages in Lower Bengal, the periodicity in flowering occurs as markedly as in the case of the wild plant. In 1857 and 1858, many of the Bamboos near Calcutta, also on Paramath, flowered and seeded abundantly, but in no case that I am aware of, did a general death of the Bamboos follow the seeding: as is stated to be the case in Canara. (See paragraph 6 of letter of the Collector

* Original papers are herewith returned.

of Canara.) So far as I observed the phenomenon, only the flowering shoots died, and their place was soon taken by young shoots springing from the roots of the plant, but during the periods of flowering and seeding the foliage almost entirely disappeared from the plants.

In the Botanic Gardens, Calcutta, an old specimen of *Bambusa gigantea* from Burmah, and which had been at least thirty years in the Botanic Garden, flowered for the first time in the beginning of 1861, but the specimen, though much weakened by the process, is still alive. It is most probable that in a District covered with dense Bamboo jungle, and where malarious fevers are endemic, a general flowering of the Bamboos followed by the death of the seed-bearing shoots, and a great shedding of the dense foliage would be followed by a time of comparative healthiness from the freer circulation of air allowed by a natural process almost equivalent to a clearing of the jungle.

The Bamboo is a true grass, and the seed contains a large quantity of wholesome farinaceous food.

As Mr. Stewart, the Collector of Canara, remarks in paragraph 7, it would be interesting to know if the Bamboos have seeded generally in other Districts, and to obtain this information I would suggest that this correspondence should be made widely known.

With reference to the 3rd paragraph of the Resolution of the Government of Bombay, I have the honor to request that application may be made for a supply of the seed for the use of the Botanic Gardens under my charge, and for distribution to Botanic Gardens in Europe and the Colonies where the seed will be much valued. From correspondence I have had with the Directors of the Botanic Gardens in the West Indies, I know that Bamboo seed would be much valued there. Three years ago, at the desire of the French Consul, I sent a number of plants of Bamboo to Guadaloupe, where they had been nearly destroyed by a disease.

To S. C. BAYLEY, Esq., Junior Secretary to the Government of Bengal.

SIR,

I HAVE the honor to acknowledge receipt of your letter of the 10th August, enclosing copy of a correspondence from the Bombay Government, and from the Superintendent, Botanic Gardens, and requesting the Society to favor the Lieutenant-Governor with any information they may possess regarding the seeding of the Bamboo.

2. In reply, I am directed to state that the phenomenon in question has been brought to the notice of the Society at various intervals by its correspondents, and their communications have been published in its Transactions and Journal.

3. In the year 1836, the late Sir William (then Captain) Sleeman, announced to the Society the fact of all the larger Bamboos in the Deyrah Valley having that season run to seed and ~~die~~. The particulars given by Sir William being of an interesting nature, and perhaps not generally known, I have extracted a portion of

his communication in the appendix to this letter, from the third volume of the Transactions.

4. About the same time Mr. J. B. Jones, an Indigo Planter, resident at Juanpore, mentioned to the Society the fact of the flowering in his district of a species of Bamboo which had been procured from the borders of Oude. Dr. Spilsbury, Surgeon, Political Agency, Saugor and Nerbudda Territories, also communicated in 1842, the circumstance of all the Bamboos from Jubbulpore to Mundlah having seeded in 1839, and died shortly afterwards.

5. Turning from the publications of the Society to other sources, it may not be out of place to remark, that Roxburgh, in his *Flora Indica*, alludes to several kinds of Bamboos which are known to flower, more especially the *Bambusa arundinacea* (the common *Bans* of the natives) *B. tulda* (the Tulda Bans) and *B. spinosa* (the Behor Bans) or thorny Bamboo. Alluding to the first he writes, "when in flower the tree is generally destitute of leaves, and as the extremity of every ramification is covered with flowers, the whole tree seems one entire, immense panicle." Referring to the second, he observes, "before these trees blossom they must be of considerable age, several years; and even then it is seldom they can be found in this state; at this period the whole plant is destitute of leaves, and forms one immensely oblong, waving panicle." Again, in respect to the third kind, he says:—"this beautiful, middling sized, very elegant species, I have only found in the vicinity of Calcutta, where now and then some of the oldest are found to blossom about the beginning of the rains in June."

6. Buchanan, in his journey from Madras, through the countries of Mysore, Canara and Malabar, alluding to the trees he observed in passing through the Animalya forest, writes thus regarding the Bamboos:—"Here are both the hollow and the solid kinds. When fifteen years old, they are said to bear fruit and then to die. The grain is collected by the rude tribe called Malasir, and is occasionally used by all ranks of people."

7. Dr. Wallich alludes to the subject in a report to Government in the year 1825, in reference to the celebrated grove of Bamboos which surrounds the extensive city of Rampore, in Rohilkund, to a breadth of 30 to 40 feet. "I had heard," observes Dr. Wallich, "a great deal about this unique object, and was, therefore the more solicitous to collect all the information I could on the spot. It has been in a state of universal blossoming in 1824, so universal that there was not among its millions of stems a single one to be seen which was not dead, they were all leaning on each other or fallen to the ground. I observed with peculiar pleasure that the Nawab had adopted a very effectual and judicious plan of defending the tender age of the myriads of seedling Bamboos which were seen growing on the site as thickly as you can conceive it possible, by not allowing a single one of the old and withered stems to be cut or in any way disturbed. I was told by some old inhabitants that the hedge was reproduced in the same manner forty years ago, (I should have estimated its age at only 25 years) and that similar renewals have succeeded each other for ages past. I found the tree to be of the common unarmed kind, and

was surprised to find that the largest even were inferior in diameter as well as in the thickness of the sides."

8. Dr. J. D. Hooker, in the account of his excursion to Tonglo from Darjeeling, has a few remarks on the flowering of the Bamboo. "At about 4,000 feet the great Bamboo ("Pao" Lepcha) abounds; it flowers every year which is not the case with all others of this genus, most of which flower profusely over large tracts of country once in a great many years, and then die away; their place being supplied by seedlings, which grow with immense rapidity. This well known fact is not due, as some suppose, to the life of the species being of such a duration, but to favorable circumstances in the season." (*Himalayan Journals*, Vol. I., page 155.)

9. The age to which the Bamboo will attain under favorable circumstances, and whether different varieties have different ages, has never, it is believed, been accurately ascertained. Sir William Sleeman, indeed, mentions (*Rambles and Recollections of an Indian Official*) that the life of the common large Bamboo is about fifty years, but he does not state his authority for the assertion; in his communication to the Society already referred to, he remarks that he is not aware of its ordinary age. Dr. Wallich mentions in his report quoted above; that he should have estimated the age of the Rampore plant at only twenty years, though the inhabitants stated it to be about forty, that is to say, a flowering similar to that he describes had not taken place for forty years. Mr. Jones remarks in his communication to the Society, already cited, that the sign of bearing to which he alludes had showed itself after the lapse of twenty years, and that some very old people could not call to their recollection when it had previously borne seed. This circumstance, coupled with the fact, that this bearing is not confined to the more matured plant, both old and young flowering at the same time, would almost lead one to doubt that it follows the regular course by which nature governs the other orders of vegetation; but rather that, as has been observed, it may be encouraged by particular circumstances connected with elemental changes.

10. In the early part of 1857, as may be remembered, many of the Bamboos in Calcutta and other parts of Lower Bengal blossomed and seeded abundantly; the season had been unusually dry throughout Eastern Bengal and on to Assam, where the scarcity of grain was much felt. Mr. Jones, in the paper above mentioned, observes that native superstition assigns to the appearance of the seed a certainty of impending famine, for, say the Brahmins, "when Bamboos produce sustenance we must look to heaven for food." But he adds, "for the hundredth time, perhaps is brahminical prescience belied, for never was there a finer crop of Rice in the field than in the present season of 1836." That the scarcity of food has been partially relieved by the seeding of the Bamboo we have an instance in the case cited by Mr. Stewart, the Collector of Canara, in the papers now under acknowledgment; as also in another which was communicated by Mr. Charles Bicklynden to the Society in 1842 in the following words:—

"In the month of February of the year 1812, a failure occurred in the Rice crops in the Province of Orissa. Much distress was the consequence, a general

famine was apprehended, and would no doubt have taken place, but for a merciful interposition of Providence in causing a general flowering of all the bamboos of the thorny kind, both old and young, throughout the district.

"The grain obtained from these Bamboos was most plentiful and gave sustenance to thousands; indeed, the poorer, and, therefore, the greater portion of the inhabitants, subsisted for some time solely on this food. So great was the natural anxiety that was evinced to obtain the grain that hundreds of people were on the watch day and night, and cloths were spread under every clump to secure the seeds as they fell from the branches.

"Soon after this general flowering had taken place every bamboo died, but the country was not long denuded of this elegant tree, for such of the seeds as escaped the vigilance of the inhabitants, germinated in a very short time, and a new race of bamboos sprung up to supply the place of the former generation.

"I have been informed that no other flowering has taken place since that period now thirty years ago."

11. In conclusion, I am instructed to add that should the Society be able to collect any further information on this interesting subject, it will be duly communicated.

I have, &c.,

A. H. BLECHYNDEN,

Secy. A. and H. Society.

METCALFE HALL,
Calcutta, 15th September, 1864. }

APPENDIX.

Particulars relating to the periodic flowering of the Bamboo. By Captain W. H. Sleeman.

ALL the large Bamboos, whose clusters and avenues have formed the principal feature in the beauty of Dehra Doon, ever since the valley became known to us, or for the last quarter of a century, have run to seed and died this season: as well those transplanted from the original stock last season as those transplanted twenty years ago. This is the character of the Bamboos—all the produce of the same seed will run to seed and die in the same season, without reference to the season in which they may have been transplanted from the original stock; and unless we have them from different stocks, we shall always be liable to lose all that we have the same season, and to have our grounds deprived for eight or ten years together of what may have been their principal ornaments; for the Bamboo does not in less time attain its full size and beauty. The shoots of the first season come up small, whether they be from the original stock or seed, or from transplants from the original stock. We may take from the original stock Bamboos six inches in diameter with a sufficient portion of the roots, and transplant them, but the shoots of the first season from this stock will still be very small, those of the second season will be larger, those of the third larger again, and so on till in about eight or

ten years they attain their full size. It is well known that Bamboos do not increase in diameter after they come above ground; they shoot out as thick as they are to be, and increase only in length after they come up. What is the ordinary age of the Bamboo I know not, but the people of the hill and jungly tracts of Central India calculate ages and events by the seeding of the hill Bamboos; a man who has seen two Kutungs or two seedings of the Bamboo, is considered an old man, perhaps sixty years of age.

The Bamboos which spring from the seed may be left to grow where the seed is sown, and they will attain perfection, either in clusters, rows or avenues, according to the taste or convenience of individuals; but the superfluous portion should be removed and transplanted. Portions of the original stock may be taken off in stems and roots any season, but the smallest Bamboos should be selected, and all except one or two stems should be cut short, one or two must be left entire; and unless they are small, the wind makes them disturb the roots too much in spite of all precaution. Some people get a crop of Bamboos by burying the whole of a large stem and its roots lengthwise; this was often done by Mr. Shore and Colonel Young in the Dehra Doon.

In submitting the above correspondence and recommending its publication in the proceedings, the Council express the hope that Members in the country will favor the Society with any information they may possess with the view of enabling them to communicate again with Government on the subject.

Letters were read—

1. From Col. Phayre, Chief Commissioner, British Burmah, in reference to the resolution passed at the last Monthly Meeting on the subject of the Cotton lately exported from the Tenasserim Provinces to Calcutta.

"I believe you will have"—writes Col. Phayre—"a letter from Mr. Fowle as to the Cotton which was shipped from Moulmein and which proved so good.

"At first I thought it must be Cotton grown from Pernambuco stock, which I know was introduced into Moulmein many years ago; but I think there is now no doubt but that it is indigenous cotton, or that which has been introduced from the Shan States, and is grown by Karens and Shans along the rivers and streams of the Province Amherst, which is the name of the Northern District of Tenasserim. Now, this cotton was unknown beyond the limits of Tenasserim until the price offered brought it forth. I need hardly say that no exertion shall be wanting to encourage the extension of the cultivation as much as possible."

2. From Captain James Masson, Darjeeling, 15th August, of which the following is an extract:—

"I would bring to yours and the Society's notice that the green Indigo plant flourishes here like a weed. I have a number of very healthy plants grown from seed; and I am now trying cuttings from them, which I have little doubt will succeed. Can you kindly tell me the process of making that Indigo? I attempted it last year, but having very little time I could not give proper attention to it and then failed; this year I shall have more time."

The Secretary mentioned that he had afforded the necessary information.

3. From the Secretary Agricultural and Horticultural Society, Madras, acknowledging receipt of a further supply of Bael seed (*Egle Marmelos*) and promising to send, as requested, some seed of *Euonymus crenulatus*, the wood of which is reported to be a substitute for Box, and plants of *Hoya Imperialis*.

4. From the Deputy Agent, E. I. Railway, intimating in reply to a further reference to him, that he has made every enquiry, but has been unable to trace out anything with regard to the ninety Mahogany trees remaining out of the one hundred supplied in 1856 from the Society's garden.

Resolved, that the Secretary be requested to state, in reply to the letter of the E. I. Railway Company, that the one hundred Mahogany trees were given on the understanding that a Report would be sent to the Society in due course, and that the letter now read, stating that they cannot be traced, is not satisfactory.

5.—From Messrs. Law, Somner & Co., Melbourne, dated 23rd June, sending invoice and bill of lading for three casks of agricultural seeds shipped per *Dordeaux* at the end of May.

The Secretary intimated that these seeds had not yet been received, and the season for distribution is fast passing away.

6.—From Messrs. Geo. Wright & Co., of Liverpool, dated 20th May, advising despatch per *Lady Palmerston* of the Society's annual consignment of seeds from Messrs. D. Landreth and Sons, of Philadelphia.

7.—From Messrs. James Carter & Co., of London, dated 25th July, with invoice per Overland Steamer of English vegetable and flower seeds.

(Saturday, the 20th of October 1864.)

Baboo Peary Chand Mittra, V. P. in the Chair.

The proceedings of the last Monthly Meeting were read and confirmed.

The following Gentlemen proposed at the last Meeting were elected Members :—

Dr. J. W. Mountjoy, Baboo Hurro Chunder Ghose, Dr. W. R. Hooper, Captain W. S. Millard, Lieut.-Colonel R. Campbell, Dr. Foster Maynard, Messrs. D. W. Taylor, E. J. French, W. B. Chardon, E. G. Buskin, and Lieutenant E. M. Woodcock.

The names of the following Gentlemen were submitted as candidates for election :—

N. Stuart Alexander, Esq., C. S., Purneah,—proposed by the Secretary, seconded by Mr. W. G. Bese.

R. E. Egerton, Esq., C. S., Nagpore,—proposed by the Hon'ble Geo. Loch, seconded by the Secretary.

C. Grant, Esq., Darjeeling,—proposed by Mr. Grote, seconded by Mr. J. A. Crawford.

Manager Station Garden, Rajkote,—proposed by the Secretary, seconded by Mr. C. E. Creswell.

Baboo Hitlioll Misser, Mauncoor,—proposed by Baboo Protap Narain Sing, seconded by Baboo P. C. Mittra.

D. G. Nicholson, Esq., Barrister-at-Law, Moulmein,—proposed by Mr. J. A. Crawford, seconded by Mr. W. Stalkartt.

R. C. Oldfield, Esq., C. S., Futteeaghur,—proposed by the Secretary, seconded by Mr. C. E. Creswell.

W. L. Heely, Esq., C. S., Calcutta,—proposed by Captain W. N. Lees, seconded by Mr. J. A. Crawford.

Mahomed Rafeek, Judge Small Cause Court, Monghyr,—proposed by Mr. Charles E. Lance, seconded by the Secretary.

P. Auchiditzky, Esq., Merchant, Akhyab,—proposed by Dr. Tonnerre, seconded by Baboo P. C. Mittra.

F. J. Platta, Esq., Superintendent of Police, Furreedpore,—proposed by Mr. Thomas Brae, seconded by the Secretary.

The following presentations were announced:—

1.—Selections from the Records Government of India, P. W. D., Nos. 43 and 44. Presented by the Government.

2.—Sericulture in Oude, by Dr. E. Bonavia. Presented by the Author.

3.—Catalogue of Seeds collected in the Botanical Gardens, Calcutta. Presented by Dr. Anderson.

4.—Seeds of *Euonymus crenulatus*. Presented by the Agricultural and Horticultural Society of Madras.

5.—A glazed case of Plants from Bruges. Presented by Baron Serclaes. But few of the contents of this case have reached in a living state.

COTTON AND TOBACCO FROM BRITISH BURMAH.

Reports were submitted by the Cotton and Tobacco Committees on certain samples submitted at recent Meetings, as received from Major Ripley, Captain Sladen, and Mr. Fowle. Ordered, that copies be furnished to the respective senders.

EFFECTS OF THE LATE GALE ON THE SOCIETY'S GARDEN.

A Report and Tabular Statement were submitted from the Gardener, fully descriptive of the great destruction caused by the severe Gale of the 5th October. The following is an extract from the Report:—

First.—*Fruit Trees.*—Our greatest loss amongst these will be Mangoes—100 are simply marked as blown down, but I doubt much whether one-fifth will ever be of any service, but I wish to try and raise all, as many as we can, more especially those over the young stock, as shade is so much required; in so raising we shall have to cut away the greater portion of the top: this I think will destroy many, as they don't bear close pruning well.

Second.—*Chrysobolanus Icaco*—is destroyed, and *Callynacelon* much damaged. Sapotas all destroyed. Avagado Pear, only one left. Cocoanuts have been much injured, more so than expected; other fruits all more or less injured.

Third.—Young Stock.—Our loss with these has been trifling, considering that nearly every tree above was blown down. I quite expected more than half would be destroyed. Of the 5,528 injured, the damage is only trifling, and think that very few will be lost out of them. We had near 6,000 young Mangoes in pots. Seedlings.—These were much shook, as they had not the root hold that older plants had for their protection.

Trees.—Amherstia—these were blown down. We have righted them again, but it is very doubtful about their recovering. *Araucarias*—since the list was made, I find 11 large ones are destroyed; in trying to save some, I found we could not do so: there are 3 large ones remaining, but damaged, and one with top broken. *Colvillea*—1 destroyed, 3 much damaged. *Grevillea robusta*—one large one destroyed. *Bignonia adenophylla*—this one supported the large *Bougainvillea*. We managed by cutting off the top, and lessening the *Bougainvillea*, to get it up again. I think it will recover, but the tree itself will die. *Poinciana regia*—this is much damaged, nearly every branch broken off. *Thujas*—nearly all were blown down, but we managed to erect most of them again; they look very seedy at present, but will recover.

Fifth.—Plants under Banyan Tree.—Our losses here are not half of what I expected, as nearly all the branches are broken away, and it was impossible to get under until all were cleared away. A good portion of the losses and damage are amongst the more common and easily propagated plants. The most damage is to the tree itself, as it affords very little shade now; it will however be much better when in full leaf.

Sixth.—Long House.—We have suffered much here, although we came off better than I expected; the roof was not lifted off, but fell flat on to them, and remained 5 or 6 days before we could clear it away; so that in addition to damage by the fallen roof, was the damage done by pressure, confinement, and by clearing the remains away, by which many were destroyed. Of *Begonias* we have suffered most of any. *Centradenias* much injured. *Hoyas* also; these were blown entirely away. Orchids very much injured: these were at end of house under the *Kijelia pinnata* which was torn up by the roots. Of *Passifloras* we have had a great loss, chiefly large plants. *Stephanotis*—the remaining plants are much injured, and many other things much injured. Of these many will yet die, being so much shaken.

Seventh.—Shrubs and border plants.—Our loss here will yet be much greater; when they pass through the hot months of March, April and May next, they will then die off very fast. Still our loss might have been greater. I found more standing than I guessed for, as the gale swept over this part most fearfully, and seemed to sweep right along the surface of the earth, and as if it would clear all before it. We secured all we could, but they now present a very poor appearance. Many things are making a premature growth, such as they ought to make in 4 months to come. This will no doubt be all destroyed by the coming cold season. Most of our things being small, is much in their favour; had they been old or large, they would all have been destroyed.

Eighth.—Layers and Gooties and Grafts.—We have had a heavy loss here, the work of past 5 months swept away at once, both amongst fruits and flower plants. I don't think we shall have three dozen Mangoes saved, all are scattered abroad; and of choicer flowering and ornamental plants all destroyed.

Ninth.—Miscellaneous—Sugar-cane all blown down, but not many I think seriously injured. We cannot yet ascertain for certain, until all are looked through, which we cannot do at present. We have lost of bell glasses 54, all of the larger size; this will be a great loss to us, as many things can be increased only by aid of

Mr. Errington reports, in a separate paper, that every erection in the garden, with the exception of his dwelling-house, was levelled to the ground, and that the thatch on the top of his house was blown off, and the house itself much shaken.

Resolved, that a Special Committee, consisting of Messrs. W. G. Rose, W. Stalkartt, C. E. Croswell, Joseph Agabeg, and J. A. Crawford, be requested to inspect the garden, and offer such recommendations as may appear desirable with reference to its present condition.

SILK CULTIVATION IN THE PUNJAB.

Read the following letter from H. Copo, Esq., of Umritsur, dated 19th September.—

"You are aware that I continue still deeply interested in the cultivation of silk in the Punjab, and your Society, whose Journal contains several papers on this subject, which have been considered worthy of reprint by the local Government, will, I am sure, be gratified to hear that I have, during the past season, obtained a larger number of cocoons than in any previous season. In 1860 my crop was 3½ Maunds. This year it is 9½. One-half of these have been sent to Bengal, where Messrs. Jardine, Skinner & Co., with their usual liberality, allowed them to be reeled at one of Messrs. Watson's factories. The rest have been reeled here, and the total result, though the scale is very small, will, I doubt not, be so highly satisfactory in a pecuniary point of view, that I propose forming a small Silk Company for next year, not because the funds are required, but because I wish practically to interest others in the cultivation.

"We had a practical proof of the success of silk cultivation at Peshawar, where a small Association, in which I was a shareholder, was formed at the end of 1863. The result has been a profit of Rs. 42 per cent, on the capital invested. A larger undertaking will no doubt follow in that Province during the season of 1865. The gentleman who conducted the operations undertook to supply silk-worm eggs; and, to judge of the number of applications registered in the *Punjab Gazette*, I may reasonably take it for granted that the interest in silk cultivation in the Punjab is extending, as I ventured to predict it would, when I first recommended it to the attention of the public more than ten years ago. The quantity of silk produced in the Umritsur and Goordaspore districts has increased more than 100

per cent. this year over last; and I have no doubt the liberal awards of the juries of the Punjab Exhibition of 1864 will materially aid in promoting the cultivation. Jaffer Allee, to whom your Society awarded a Silver Medal in 1859, obtained a similar distinction from the Exhibition, while his son-in-law, Soobhan, was awarded eighty Shares (Rs. 80) from the General Prize Fund. A rearer at Tuloknath, probably Khurream Khan, received seven Shares, while a Goojrat cultivator was awarded my special Prize of Rs. 50 for best Punjab reeled silk. Another Medal was given to Nasir Khan Oella Khan (who befriended Stoddart and Conolly in Bokhara black-hole), who commenced cultivation at my suggestion. In ten years more, if God should be pleased to spare our lives so long, I hope to report an out-turn of hundreds of maunds, instead of hundreds of seers. If some of our Tea Planters in Kangra would but turn their attention to Mulberry-planting, I feel assured they would find it more profitable than Tea, at least on such lands as are not exactly suited, though devoted to the shrub.

"Since writing the above, I have ascertained that the quantity of silk produced in Goordaspore District is much greater than I calculated (one man, named Alladita, of Chelasower, having reeled more than twenty-two seers Lahore,) and I find that the quantity from Umritsur and Goordaspore cannot be less than 100 seers, Lahore or more than three Indian maunds, representing, at present rates of silk in Umritsur, a net return of some Rupees 2,000, being about 1,200 in excess of the previous year. If the Zemindars could only be induced to plant Mulberry trees on the verge of their fields, this out-turn would be increased ten-fold in a short time."

Letters were read—

From W. F. CAMPBELL, Esq., in respect to the seeding of the Bamboo in the Tipperah District.

"I arrived here (Comillah) two days ago," writes Mr. Campbell, "and have been making enquiries about the Bamboo seed.

"I find our Collector, Mr. Mangles, has been called upon for a Report, and he has sent in one. It would appear, that the large Bamboos of the Plains seeded last year, and the seed was like grains of rice; this last year the Moolee Bamboos of the Eastern Hills have flowered and seeded, but their seed is quite different. I have sent you by this day's dawk banghy a couple of the pods or seeds from which the Moolee Bamboo is grown. When I was in the Hills to the South of the Sylhet district during last cold weather, I found the whole of the Hill country for miles and miles in flower, and afterwards saw the pods, which I now send, on the Bamboos. The Bamboos all died; the pods that have fallen have, however, germinated, and no doubt the Hills will be covered as thick as ever, though the Bamboos will not be of any use for two or three years. This has caused great inconvenience, for no Bamboos can be had for building purposes, except at a most exorbitant price, in fact more than double what we used to pay.

"The two pods I have sent you have sent out shoots, as you will see. Mr. Mangles has planted some of them in his garden, and they are now some four feet high.

From Dr. H. CLEGGHORN, Simla, dated 19th October, presenting a paper for the Journal entitled "Excursion to the Valleys of the Gori, Pubur and Tonse rivers."

From C. BROWNLOW, Esq., presenting a paper for the Journal, entitled "On the feasibility of a mixed system of open-air silk culture, with reference more particularly to the climate and forests of Cachar and Assam."

From Under-Secretary, Government of Bengal, dated 19th September, submitting copy of correspondence on the subject of "Cattle Disease in the Madras Presidency."

From JAMES COWELL, Esq., London, dated 23rd August, returning his best acknowledgments for his election as a Corresponding Member of the Society.

From H. L. DAMPIER, Esq., Commissioner of Nuddea, dated 1st October, notifying that an Agricultural Exhibition will be held in Kishnaghur in January next, and requesting the co-operation of the Society.

Proposed by Baboo Joykissen Mookerjee,—seconded by Kowar Harendra Krishna, and agreed, that the Council be requested to consider and report what aid the Society can render to the proposed Agricultural Exhibitions in Bengal.

(Wednesday, the 23rd November 1864.)

A. GROTE, Esq., President, in the Chair.

The Proceedings of the last Monthly Meeting were read and confirmed.

The following Gentlemen were elected Members:—

Messrs. N. S. Alexander, c. s.; R. E. Egerton, c. s.; C. Grant; D. G. Nicolson, R. C. Oldfield, c. s.; W. J. Heely, c. s.; P. Auchitzky; F. J. Platts; Mahomed Rafeek; Baboo Hitloll Misser, and the Manager of the Station Garden, Rajkote.

The names of the following Gentlemen were submitted as candidates for election:—

George Scott, Esq., Merchant, Penang,—proposed by the Secretary, seconded by Mr. W. G. Rose.

M. Henderson, Esq., Merchant, Calcutta,—proposed by Mr. W. Haworth, seconded by the Secretary.

E. A. Trevor, Esq., Royal Engineers, Lahore,—proposed by Mr. Grote, seconded by Mr. J. A. Crawford.

Dr. C. E. Raddock, Bijnore,—proposed by Mr. Grote, seconded by Mr. Crawford.

Lieutenant W. E. Forbes, Royal Artillery, Sultanpore, Oude,—proposed by Dr. B. H. Perkins, seconded by the Secretary.

NURSERY GARDEN.

A report was read from the Special Committee appointed at the last meeting, to inspect the garden and offer such recommendations as may appear desirable with reference to its present condition. The Committee report that they found the garden in the deplorable state described in the Gardener's statement as respects the destruction of trees and shrubs of all kinds, and the demolition of various buildings.

They have instructed the Gardener to lose no further time in raising, in the first instance as many of the fruit and other trees as have suffered the least damage, and then to remove all such as are hopeless; he will then be better able to attend to minor details. The Committee have authorized some extra hands for a short time. In respect to the various erections which have been destroyed, the Committee consider that the smaller ones, such as Coolies' lines, pottery and tool sheds, &c., should be renewed with the least possible delay. They are not at present prepared to offer an opinion in regard to the conservatory, as its renewal will involve a larger outlay, and it seems to them a question whether it would not now be better to order iron pillars from England, as proposed sometime ago, in lieu of renewing the wooden posts; and also to change the site of the house from its late position to the eastern side of the garden as altogether more convenient.

Resolved,—that the report be confirmed, and the estimate of Rs. 900 for repairing the various buildings be sanctioned.

The Council recommend, in reference to the resolution passed at the last meeting, that a silver medal be placed at the disposal of the Committees of Management of each Divisional Agricultural Exhibition in Bengal, to be awarded for the best specimens of such produce as they may select. Agreed to.

The Secretary announced the receipt per *Bordeaux*, from Melbourne, of the consignment of Agricultural Seeds ordered in the early part of last year. Though the vessel left Melbourne at the end of May, she did not arrive here before the beginning of November, and consequently the greater portion of the consignment, especially the cereals, will be of very little service. Some kinds, such as clover, lucerne, mangul wurzel, &c., are now under distribution, but it is feared that the lateness of the season will prove prejudicial to their growth.

Treatment of the root of the Tea plant.

The Secretary called the attention of the meeting to the following extract from the proceedings of the monthly meeting of the Agricultural and Horticultural Society of Madras, held on the 5th October, in reference to the tea plant:—

“Read letter from J. McIvor, Esq., dated Ootacamund, 24th September 1864, on the subject of the treatment of tea plants and seeds, in reply to questions asked and suggestions offered by correspondents.

Resolved,—That this be printed in the Proceedings of the Society.

Mr. McIvor stated that the tap-roots of tea can be cut off with advantage, as it is only necessary to preserve the tap-root when planting tea in localities subject to periods of long continuous drought; in this case the tap-root is of great advantage, as it penetrates deep into the soil and draws moisture for the support of the plant from a depth not affected by drought, but where the rainfall reaches from 40 to 80 inches, and nearly uniformly distributed throughout the year, then the removal of the tap root is very desirable, as it encourages the growth of the lateral

roots, producing numerous fibres near the surface of the ground; the action of these fibres, or rather the spongelets at the ends of them, being rapidly to absorb the nutriment from the point where it is most pure and abundant, and thus, after the fall of rain, by immediately introducing a large quantity of nutriment into the plant, causes it to throw out fresh and successive flushes of leaf."

Some discussion ensued after the reading of the above remarks, in the course of which it was observed, that the opinion advanced appeared to be opposed to the practice in Assam and Cachar, where great care was taken in transplanting not to injure the tap root. It was further remarked that though the adoption of such a course might have the effect of causing a larger produce of leaf per acre, it would probably tend to shorten the life of the plant.

Resolved,—that the above extract be printed in the proceedings of this day's meeting, with the view of eliciting the opinion of Tea Planters in Assam and Cachar on the subject.

Letters were read—

From the Secretary of the Agricultural and Horticultural Society of Madras, advising the despatch of two plants of *Hoya imperialis*.

There have arrived in excellent condition.

From the Secretary, Royal Horticultural Society of London, presenting some of the earlier numbers of their Journal to complete the series in the Society's Library.

From E. Fowle, Esq., Secretary, Agricultural and Horticultural Society of British Burmah, intimating that he had shipped two Wardian cases filled with Orchids per Steamer *Persia*, and which have been lost by the wreck of that vessel in the gale of the 5th October.

From the Deputy Agent, East India Railway Company, reporting further in respect to the Mahogany trees, (100) supplied in 1856. The Agent states that in addition to the ten trees previously referred to, it has been discovered that 50 of the Mahogany trees were planted in the compounds of the workmen's bungalows at Raneegunge by Mr. Mansel, under Mr. White's orders; of these 6 are now, from 20 to 25 feet high and 6 to 8 inches diameter, and 2 are 10 or 12 feet high and 3 inches in diameter. These 8 are all planted in Mr. Mansel's own garden, where care has been taken of them. The remaining 42, which Mr. Mansel says that he planted in the compounds of the other bungalows, have entirely disappeared; Mr. Mansel says he kept a mallee to look after them for some months after they were planted, but that his salary was disallowed, and the trees then died for want of care.

From the Secretary, Asiatic Society of Bengal, enclosing copies of correspondence in connection with an exchange of plants and seeds with the Queensland Acclimatisation Society.

The Council report that they have authorized an interchange.

From J. W. Armstrong, Esq., Cuttack, dated 17th November, in respect to this year's importations of vegetable seeds "I am glad to say,"—writes Mr. Arm-

strong—"that all the small seeds did well this year in Orissa, both English and American, but especially and as usual the American.

The English peas do not do so well as the American, which are all excellent. I send you "our Station" remarks upon the seeds of this year.

*English small seeds all *very* good, but the salad, and turnip and carrot, some of these failed. English Peas, *half, very good*, rest almost a failure.

American seeds all good, but a *very poor* supply sent in *each* packet, more especially the important seeds, kpolekole, cauliflower, beet and cabbage.

Peas scanty too and no Tom Thumb pea this year, which is a *real* disappointment to all. This excellent pea is most fruitful, wonderfully so of its class; it grows but 6 or 7 inches high and then blossoms and bears a wonderful number of pods.

From its so early reaching maturity it is a *most* valuable *early* pea, and it is by far A, 1 in this respect. It is to be hoped that a good supply of this pea will be ordered for 1865. The other American peas are very good. In the first rank are the black eyed marrowfat and the dwarf sugar pea, the white marrowfat and the green colored pea. These kinds always grow most luxuriously, *never* fail, and give a most abundant crop. If we get then, as our pea crop seed, the following American ones, we cannot desire more:

The Tom Thumb, A, 1.	{ for early and first Crop.
The Dwarf Sugar Pea,	
The Black Eyed Marrowfat.	
The White ditto.	
The Tall Sugar Pea.	

These are ample, if we get enough of each kind in each parcel."

The Secretary mentioned that he had received several other letters reporting favorably on the seeds distributed this year. In reference to peas from England, the Gardener has found that immersion for 4 or 5 hours in cold water has had a good effect in stimulating their germination, inasmuch as seed so treated had vegetated most freely, while others, not so treated, had germinated indifferently.

Wednesday, the 21st December, 1864.

A. GROTE, Esq., President, in the Chair.

The Proceedings of the last Monthly Meeting were read and confirmed.

The following Gentlemen were elected Members:—

Messrs. George Scott, M. Henderson, E. A. Trevor, Dr. C. E. Raddock and Lieutenant W. E. Forbes.

The names of the following Gentlemen were submitted as candidates for election:

H. Beveridge, Esq., c. s., Sylhet,—proposed by Mr. G. S. Fagan, seconded by Mr. W. L. Healy.

The Rev. J. Cole, Superintendent Lawrence Asylum, Sanawur,—proposed by the Secretary, seconded by Mr. W. G. Rose.

M. T. Pearson, Esq. Solicitor, Calcutta,—proposed by Mr. W. Swinhoe, seconded by the Secretary.

The following contributions were announced :—

1.—Report of the Agricultural and Horticultural Society of Bombay, for 1863. Presented by the Society.

2.—On the reversion and restoration of the Silk-worm, by Captain Thomas Hutton. Presented by the Author.

3.—Selections from the Records of the Government of India, P. W. D., No. 45. Memo. on the Hooghly. From the Government of Bengal.

4.—Selections from the Records of the Government, N. W. P. Report on the Government, Botanical Gardens, N. W. P. From the Government of Bengal.

5.—Journal of the Asiatic Society of Bengal. No. 4 of 1864. From the Society.

6.—A collection of French Vegetable Seeds. Presented by Dr. Tonnerre.

The Council submitted a list of apparently irrecoverable subscriptions, embracing a period of from 1853 to 1864, amounting to Rs. 4,095. Agreed that this sum be carried to profit and loss.

The Gardener submitted his Report on a trial sowing of the Australian field seeds received last month. The result is tolerably satisfactory, considering the length of the voyage (5 months) from Melbourne to Calcutta, in the *Bordeaux*.

Communications were read—

1.—From Secretary Government of Bengal, submitting extracts from letters from the Landholders Association, on the subject of the rotation of crops, and requesting the opinion of the Society thereon in its relation to Indigo.

The Council submitted several replies which they had received from various parts of the country, to queries which they had addressed. They recommend that copies of these replies be sent in to the Government of Bengal, in answer to its Secretary's letter. Agreed to.

2.—From Dr. H. Cleghorn, presenting two papers for the Journal, viz., a list of the useful plants in the Sutlej Valley, and a memorandum on timber procurable from the Indus, Swat, and Kabul Rivers.

3.—From C. F. Montresor, Esq., President of Committee of the Agricultural Exhibition at Burdwan, offering his acknowledgments for the Silver Medal awarded at the last Meeting.

4.—From C. T. Buckland, Esq., President of Committee of Agricultural Exhibition at Dacca, intimating that the Society's Silver Medal has been awarded to Mr. A. D. Dunne, for the best specimen of Cachar Tea.

5.—From J. A. Crawford, Esq., submitting samples of various vegetable products for which prizes were awarded at the Dacca Exhibition, and requesting an opinion on them. "These are samples," observes Mr. Crawford, "of first, second and third prizes; and what the Committee wish to know is, have the awards been correctly given as to quality; for instance, ought in any case, the 2nd prize to have

gone to the sample marked 1st, and so on. The object is not to find fault with the awards, but to gain information for the future."

Resolved, that these specimens be transferred to the various Standing Committees for report.

6.—From Captain W. C. R. Mylne, Gwalior, enclosing a letter to his address (in continuation of the subject mooted at the last Monthly Meeting) from the Acclimatisation Society of Queensland, in respect to an interchange of seeds and plants. Agreed to.

7.—From J. Gerrard, Esq., submitting leaves collected from the district of Hill Tipperah, and requesting to be informed if they belong to the tea plant.

The Secretary mentioned that Dr. Cleghorn had kindly examined these leaves and pronounced one of them to be a *Cinnamomum*, and two of the others to belong to Ternstroemiaceous plants, and appeared to be *Thea*, but that he could not, without having twigs, bearing flowers or fruit, give an opinion as to their specific identity.

For the above communications and contributions the best thanks of the Society were accorded.

A. H. BLECHYNDEN.

Secretary.

R E P O R T

OF THE

Agricultural and Horticultural Society

OF INDIA.

*Report from the Council to the Society at the Annual General Meeting
of the 18th January, 1865.*

THE Council have to make the following Report to the Members of the Society on the occasion of their present Annual Meeting.

They have to commence, as usual, with a summary of the state of the subscription list, and they regret to observe that though the number elected during the past twelve months, namely one hundred, is a very fair average, yet the number of deaths, resignations, and removals for non-payment, have been so unusually heavy as not to show any advance in the list of paying members over the year 1864.

The usual classified list is appended :—

CLASSIFICATION.	In 30 previ- ous years.	In 1861.	In 1862.	In 1863.	In 1864.	In 1855.	In 1856.	In 1857.	In 1858.	In 1859.	In 1860.	In 1861.	In 1862.	In 1863.	In 1864.	Gross Totl.	Total real num- ber at the close of 1864, after de- ducting lapses.
		In 1861.	In 1862.	In 1863.	In 1864.	In 1855.	In 1856.	In 1857.	In 1858.	In 1859.	In 1860.	In 1861.	In 1862.	In 1863.	In 1864.		
Honorary Members, ...	13	0	1	1	0	1	0	2	0	0	1	0	0	0	0	18	11
Associate Members, ...	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2
Corresponding Members, ...	1	1	1	1	0	0	0	0	1	0	0	1	0	0	2	8	6
Civilians, ...	300	22	16	18	6	23	23	17	19	28	28	22	13	12	18	565	183
Merchants and Traders, ...	264	20	12	5	16	18	31	11	20	15	18	17	19	24	17	507	153
Indigo and other Tropical Agri- culturists, ...	226	19	13	10	7	14	12	10	14	20	15	15	21	20	20	436	184
Military Officers, ...	212	34	18	22	19	26	22	12	14	27	38	26	25	10	21	526	149
Medical Officers, ...	97	4	5	3	4	6	9	3	3	16	11	6	7	5	7	186	50
Artists, ...	99	8	8	8	5	5	7	14	19	4	6	8	3	7	9	210	67
Clergy, ...	17	1	1	1	1	2	1	2	0	0	1	0	0	2	0	29	5
Law Officers, ...	51	6	3	1	3	6	2	1	5	2	1	2	4	2	3	92	23
Miscellaneous, ...	15	6	0	0	10	0	0	2	7	5	5	0	12	9	3	74	86
	1,298	122	78	69	72	100	109	72	102	118	123	97	104	91	100	2,655	819

N. B.—Of these 819 Members 186 are Resident in Calcutta 549 in the country and 84 in Europe.

The lapses alluded to in the last column comprise 22 deaths, 55 resignations, 22 whose names have been removed for non-payment of subscriptions, and 58 removals from the list in accordance with Section 6 of chapter iii of the Bye-Laws, their absence from India having exceeded four years,—making in all 157.

Of the total number (819) in the printed list, 34 are Life Members, 71 are absent from India, 17 are Honorary, Associate and Corresponding, leaving 697 as the number of paying Members on the books of the Society.

As promised in their last report the Council have given their careful attention to the heavy arrears which were then shewn to be outstanding; but notwithstanding that frequent applications have been made to defaulters, they have been obliged to recommend that the large sum of Rs. 6,326 be written off to profit and loss. Of this sum Rs. 2,231 was ordered to be taken off at the May meeting, and Rs. 4,095 at the December meeting. After deducting this amount there still remains the sum of Rs. 11,125 unpaid, of which Rs. 1,270 are due from Town Residents, and Rs. 9,855 from Country Members. It is to be hoped that a fair proportion of this sum may be realized during the current year, as Rs. 3,987 comprise the unpaid subscriptions of 1864. The Council would again urge on Members the necessity of more frequent and regular remittances to restore a proper equilibrium between income and expenditure.

The Council are glad to report that the importations of seeds during the last season have proved successful. The consignments from North America have, as usual, given satisfaction, and those from England have succeeded better than, perhaps, in any former year. The seeds of field crops from Melbourne have also turned out well, though they, unfortunately, reached too late in the season

* Messrs. James Smith, H. Andrew, R. H. Russell, C. S., R. T. Martin, F. Brine; Capt. T. F. O. Scott; Prince Mahomed Jelalodeen; Messrs. J. F. Hedger, J. C. Johnson, C. B. Stewart, T. J. Atkinson, James Egerton, T. H. Barry, B. W. Bingham, J. F. Bowers, W. H. Lowe, C. S., Capt. W. Eales; Lt. Coll. A. D. Turnbull; Dr. J. Davis; Major D. Ross; Capt. T. Salmon; and Dr. T. J. Morris.

to be largely distributed. Another consignment has been ordered from thence, as also from South Africa. An order for the latter was given last year through the Secretary of the Agricultural and Horticultural Society of Cape Town, but, from some unknown cause, it has not been complied with.

Two Horticultural exhibitions were held during the year. The first at Allipore in connection with the Agricultural exhibition, the second in the Town Hall. Both shows were fair average ones. A new feature in the first show was competition from the country; the produce of gardens at Kishnaghur and Arrah was submitted and gained several prizes. The sum of Rs. 895 was awarded at these shows, and 7 bronze medals:

The distribution of plants has been almost as great as last year. It would probably have exceeded it, judging from returns at the end of September, and the number of uncomplained applications at that date in consequence of an unusually heavy demand during the rainy season. But the severe gale of the 5th of October, which caused such destruction in Calcutta and the surrounding country, affected the Society's garden considerably, and since that period to the close of the year the distribution has, of necessity, almost ceased. The effects of this gale have been so fully detailed in the Gardener's report already published in the proceedings for October, that it is needless to recapitulate them in this place. It may, however, be mentioned that the various buildings, including the conservatory, have been altogether blown down, with the exception of the Gardener's house, and that the loss of fruit grafts, one of the most useful departments of the garden, has been so great, that the distribution of next season must be necessarily very limited. Most of the choicer ornamental plants have also been destroyed, while of the larger trees, such as *Amberstias*, *Araucarias*, *Grevilleas*, *Colvilleas*, *Poincianas* &c. scarcely one remains,—a loss which it will take several years to repair. The total number of plants that have been given out is 11,253, in this is included 2,906 fruit grafts. The demand for sugarcane has been limited, while for *Rhoea* (*Bahmeria nivea*) there have been many applica-

tions, and thousands of cuttings of this superior fibre-yielding plant have been distributed, which are not included in the above return. A fair proportion of both useful and ornamental plants, nearly one third, has been sent to Mofussil members.

In connection with this subject it may be observed that the Society have been in communication with the Government of Bengal in respect to the formation of a garden on this side of the river. They have suggested as a suitable site for a public garden a portion of the grounds belonging to the Kidderpore Military Orphan Asylum, and intimated their readiness, in the event of the application being granted, to remove their nursery garden to a portion of the ground, and to undertake the management of the entire establishment, provided that the expence to be incurred by such management, does not exceed that now incurred in the maintenance of their nursery garden. No definite resolution has yet been come to on this subject, as it would appear that the premises alluded to have not yet been transferred to Government pending the orders of Her Majesty's Secretary of State for India, to whom the question was submitted some time since.

The various Standing Committees have been actively engaged during the year in reporting on specimens of cotton, tobacco, coffee &c. Those from British Burmah have been especially numerous. The question of Cotton culture in the Punjab has likewise been attracting attention, and the Society have been aiding in the movement by supplying acclimatized seed which is more sought for than direct importations, as less liable to failure. In consequence of the success attending former importations steps have been taken to obtain another supply of New Granada paddy for general distribution.

Among other subjects which have been recently occupying the attention of the Society the improvement of the breed of native cattle, and the murrain which has been raging in the Madras Presidency and Lower Bengal, may be particularly noticed. Some valuable suggestions in respect to the latter have been communicated to the Government of Bengal in reply to a reference to the Society; and a rather lengthy report by a Special Committee has

been submitted in response to a Government letter regarding the former. The periodic flowering of the Bamboo, and the rotation of crops, have also been attracting attention; on both of these subjects the Society have furnished information to the Government. In consequence of references frequently made for information on various points connected with the culture and manufacture of Tea, it has been determined to invite Essays thereon, and a prize of Rs. 500 has been offered to any person who shall produce on or before the 1st. of March 1865, the best practical treatise, on such culture and manufacture, as applicable to the plains, and a like sum for a treatise as applicable to the hills. The publication in a recent number of the Journal, in a translated form, of Jacobson's hand-book for the culture and manufacture of Tea in Java, will, it is believed, also prove serviceable to the daily increasing number of persons interested in this important branch of agricultural industry in Assam, Cachar, Sylhet, Chittagong, the Punjab and our hill provinces.

It may not be out of place to add here, by way of record, that a portion of the sum of Rs. 3000, which was subscribed in 1848, for a portrait of the late Sir John Peter Grant (but which his death during his passage to England prevented the Society from obtaining) has been appropriated during the past year, by a resolution passed at the May meeting, for the manufacture of a Die for a medal to be called the "Grant medal," in memory of their late President, to be awarded for such objects as may hereafter, from time to time, be determined on. To aid the engraver in England, to whom the preparation of the Die may be entrusted, Mr. Colesworthy Grant, the artist, has kindly consented to prepare a likeness of Sir John from a lithograph in his possession.

A silver medal has been placed by the Society at the disposal of the Committees of management of each Divisional Agricultural Exhibition in Bengal, to be awarded for the best specimens of such produce as they may select.

Two numbers of the Journal, parts 2 and 3 of vol. xiii, have been published during the year. Part 4, completing this volume, is now in the press, and will appear at the commencement of 1865.

Statement of Receipts and Disbursements of the Agricultural and Horticultural Society of India from 1st, January to 31st, December 1864.

RECEIPTS.

From Members, Subscriptions collected during the year,	21,790	59	3
„ Government Annual Donation	5000	0	0
„ His Excellency the Viceroy and Govr. General's Donation to the Society,	500	0	0
„ Bank of Bengal a Loan on deposit of Government Promissary Notes,	5000	0	0
	<hr/>	10,500	0 0
„ Accruings of Interest on Government Notes, .. .. .	.. ..	545	5 4
„ Proceeds of English Oats, Wheat and Peas,	24	12	0
„ Ditto of 2 maunds of seeded Cotton,	30	0	0
„ Ditto of 1 maund of cleaned Cotton	30	0	0
„ Ditto of Sugar canes delivered from the Nursery Garden, ..	11	0	0
„ Ditto of Fruit grafts from Ditto,	114	3	0
„ Ditto of a portion of surplus stock of English, American and Native vegetable and English flower seeds,	3654	0	0
„ Ditto of copies of publications of the Society,	116	8	0
„ Ditto of Bellglasses	17	0	0
„ Members, amount for glazed cases, pots and packing charges for seeds &c.,	1863	5	9
„ Ditto amount repaid for freight on boxes of seeds forwarded in, 1863-1864	450	13	6
„ Agricultural Exhibition, the cost for pitching tents, carriage, cooly hire &c.,	292	15	0
„ Ditto, Ditto, for prize for a stand Hoe,	25	0	0
„ Sale of Country ploughs,	60	12	0
„ Ditto of Burmah boxes,	12	10	0
	<hr/>	7,702	15 3
	<hr/>	40,528	9 10
To Balance in the Bank of Bengal on 31st, December, 1863, ..	430	13	0
„ Do Do. in the hands of the Secretaries on 31st, December, 1863, ..	98	8	7
	<hr/>	527	5 7

Grand Total Rs. 41,065 15 5

DISBURSEMENTS.

By Messrs. James Carter & Co. in full of their bills for seeds, supplied in 1863,	9226	12	3
„ Messrs. D. Landreth and Sons for American Vegetable seeds supplied in 1863, and in part for Amn. Veg. seeds supplied in 1864,	4948	7	3
„ Messrs. Wrench and Sons in full of their bill of £119-15-4 for English Vegetable seeds supplied in 1863,	1202	15	0
„ Bengal Tea Company for 2 maunds of Tea seed &c.,	134	6	3
	<hr/>	15,512	8

LIBRARY.		
Brought forward, Rs. . . .		15,513 8 8
By Books purchased during the year for the Library, . . .	577 11 4	
„ Binding books during the year, . . .	29 0 0	
		606 11 4
PRINTING.		
„ Sundry parties for printing receipts and schedules for prizes for flower shows &c., . . .		103 8 0
JOURNAL		
„ Bishop's College Press for Printing &c. 700 copies of Journal part 4, Vol: XII and parts. 1, 2 and 3 of Vol XIII. . .	1680 7 9	
„ Bengal Central Press for printing and drawing 735 Copies of plates of Insects and Cocoons for Journal part 1 Vol. XIII of the Society . . .	80 0 0	
„ Messrs. Scott & Co. for printing monthly proceedings for the above, . . .	122 5 0	
		1882 12 9
NURSERY GARDEN.		
„ Ordinary expences incurred on account of the Nursery Garden from 1st December 1863 to the 30th November 1864, . .	4467 5 9	
„ Extra expences incurred for purchase of fruit seedlings for grafting, for glazed cases, pots, and for sundry other contingent expences, . . .	1283 8 6	
		5750 14 3
ESTABLISHMENT,		
„ Amount for Establishment from 1st December 1863 to 30th November 1864 . . .		8975 8
PECUNIARY REWARDS.		
„ Prizes to Mallees for vegetables and fruits at Exhibitions held on the 23rd January, and 15th April 1864, . . .	485 0 0	
„ Ditto Ditto for flowers at Ditto Ditto, . . .	382 0 0	
„ Ditto Ditto for extra prizes on the 13 January 1864, . . .	28 0 0	
		895 0 0
ADVERTISEMENT.		
„ Advertising notices of General Meetings, of shows of vegetables and flowers, distribution of seeds, &c., . . .		265 1 0
STATIONERY.		
„ Stationery, for Office books &c., . . .	85 12 0	
„ Brown packing paper for packing seeds, . . .	69 0 0	
		154 12 0
FREIGHT.		
„ Freight on boxes of seeds, books &c. sent and received from America and England, . . .		482 8 0
LOAN.		
„ Secy. Bank of Bengal for Interest and Stamped Bond for a Loan of Rs. 5000, . . .		149 12 5
FURNITURE,		
„ Sundry articles of Furniture, . . .		28 0 0
Carried over, Rs. . . .		24,813 1 5

lxxvii.

METCALFE HALL.

1.163 2 2

75 0 0

7 0 0

500 0 0

1,476 2 7

2,831 9 2

Grand Total Re.,.. 41,065 15 5

MEMORANDUM.

DISBURSEMENTS.

To amount of disbursements during the year 1864, as per statement,	39,324	6	3
" Balance in the Bank of Bengal on 31st December 1864,	2,724	0	6
" Ditto in the hands of the Secretary on ditto, ..	77	8	8
	<u>3,821</u>	<u>9</u>	<u>3</u>
Total Rupees,	41,065	15	5

LIABILITIES

Landreth and Sons for balance of consignment of American seeds 1864, \$ 668-23,	1,340	0	0
Law Sonner and Co. for a consignment of Agricultural seeds from Melbourne, £ 44-17 s, ..	450	0	0
James Carter and Co. balance of consignment of seeds for 1863, and in full of 1864, £ 919-2-5, ..	9,200	0	0
Loan from Bank of Bengal,	5,000	0	0
	<u>15,990</u>	<u>0</u>	<u>0</u>

RECEIPTS.

To amount of receipts during the year 1864 as per statement,	40,538	8	10
" Balance in the Bank of Bengal on 31st December 1863,	430	13	0
" Ditto in the hands of the Secretary on ditto, ..	96	8	7
	<u>527</u>	<u>5</u>	<u>7</u>
Total Rupees,	41,065	15	5

DEPENDENCIES.

Amount invested in Government Securities lodged in the Bank of Bengal,	16,633	5	3
Ditto of Sub scripion in arrear,	11,125	0	9
Ditto outstanding for seeds, grafts, copies of Journal, packing charges, freight &c., ..	1,781	8	3
	<u>12,906</u>	<u>19</u>	<u>0</u>

LIST OF MEMBERS

OF THE

Agricultural & Horticultural Society

OF

I N D I A.

DECEMBER 31st, 1864.

ALPHABETICALLY ARRANGED,

AND

DISTINGUISHING THE YEAR OF ADMISSION.

OFFICE-BEARERS.

President:

ARTHUR GROTE ESQ.

Vice-Presidents:

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DR. THOMAS ANDERSON.

BABOO RAMGOPAUL

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Patron:

List of Members.

* This Mark denotes Members who have compounded for their Annual Subscriptions.

† This Mark denotes Members who are absent from India, and therefore Non-contributors.

‡ This Mark denotes Members who, though absent, are desirous of continuing their Subscriptions.

HONORARY MEMBERS.

The Right Honorable Sir Edward Ryan, A. M.,

F. A. S., London,	1828	1841
Colonel John Colvin, C. B., London,		1830
J. Mackay, Esq.,		
Don Ramon de la Sagra, Island of Cuba,		
Dr. Justus Leibig, Professor of Chemistry in the University of Giessen,		1843
Major General Francis Jenkins, Gowhatty (Assam),	1828	1852
The Right Honorable Sir Lawrence Peel, London, ..	1842	1856
R. Fortune, Esq.,		1856
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Dr. R Riddell, London,	1853
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Capt. Thos. Hutton, F. G. S. Mussoorie,	1861
Capt. W. H. Lowther, Berhampore,	1864
James Cowell Esq., London,	1864

ASSOCIATE MEMBERS.

Mr. R. Scott, Head-Gardener, Royal Botanic Garden,

Calcutta,	1851
Capt. E. P. Nisbet, London,	1842

ORDINARY MEMBERS.

Admitted.

ABBOTT, Horace, Esq., Burramaseah Factory, Rampore	1858
leah,	1860
Abbott, Col. S. A. Lucknow,	1860
Abdool, Gunny, Kajee, Zemindar, Dacca,	1864
Abdool, Luteef Khan Bhadoor, Moulavee, Calcutta,	1863
Achard, Lewis, Frederick, Esq., Merchant, Akyab,	1855
Ackland, C. J., Esq., Merchant, Calcutta,	1853
Ackland, George, Esq., Merchant, Calcutta,	1864
Ady, Charles Esq., Merchant, Calcutta,	1858
Agabeg, J. Esq., Merchant, Calcutta,	1860
Agabeg, A. L. Esq., Calcutta,	1858
Ahmuty, R. Esq., Supt., Govt. Estates, Mymensing,	1847
Ainslie, W. Esq., Civil service, Patna,	1862
Alexander, † F. J. Esq., Civil service,	1855
Alexander, † H. A. R. Esq., Civil service,	1861
Alexander, † H. W. Esq., Civil service,	1864
Alexander, R. Esq., Civil service, Cuttack,	1864
Alexander, N. Stuart, Esq., C. S., Purneah,	1850
Allen, J. H. Esq., Merchant, Calcutta,	1860
Allen, Capt. A., (late, 55th N. I.,) Nagpore, C. P.,	1861
Allen, Capt. A. S. Cantonment Joint Magistrate, Cawnpore,	1853
Allowallea, * Rajah of Kapoorthullea, Jullunder,	1854
Anderson, P. Esq., Merchant, Calcutta,	
Anderson, Thomas, Esq., M. D. F. L. S. Superintendent Royal Botanic Garden, Calcutta, (<i>Vice-President</i>),	1861
Anderson, Major, W. W., (1st Bombay Lancers) Supt. H. H., the Guicowar's Contingent of horse, Rajkote, Kattywar,	1859
Anderson, William, Esq., Merchant, Calcutta,	1860
Angelo, Elliot, Esq., Merchant, Calcutta,	1859
Anley, Arthur Esq., Beahpore, Kishnaghur,	1861
Annealey, † Capt, R. M. S., (Meywar Bheel Corps,)	1858
Apcar, Thomas, Esq., Merchant, Calcutta,	1861
Apurva Krishna Bahadoor, Calcutta,	1862
Armstrong, C. M., Esq., Opium Dept., Ghazeepore,	1858
Armstrong, J. W. Esq., Supg. Engineer, Cuttack,	1862
Ashburner, Major, John, (Bombay Staff-corps) Depy. Com- missioner, Chindwarah,	1864
Atkinson, W. S. Esq., Director Public Instruction, Cal- cutta,	1864
Anley, George Esq., Civil Engineer, Balasore,	1861
Auchidtzky, P. Esq., Merchant, Akyab,	1864
Augier, P. Esq., Calcutta Mint,	1858
BADLEY, Lieut. W. F., 26th P. I., Gorruckpore,	1860
Baillie, Capt. G., Invalid Establishment, Jubbulpore,	1863

Bainbridge Herbert Esq., Tea-planter, Gowhatty, Assam, ..	1862
Baird, Major, A. F. Executive Engineer, Hazareebaugh, ..	1861
Baker, Thomas Esq., Anjooree Tea-plantation, Jorehaut, ..	1864
Balfour, G. G., Esq., Civil service, Chittagong, ..	1844
Balfour,† Lewis, Esq., Merchant, ..	1842
Barlow, G. N. Esq., Civil service, Pooree, ..	1864
Barnes, C. H., Esq., Colgong, ..	1858
Barton, G. W. Esq., Indigo-planter, Shahpore Factory, Arrah, ..	1862
Barry,† Dr. J. B., ..	1856
Barry,† G. R., Esq., ..	1859
Baugh, Major F. W. (25th N. I.,) Nynee Tal. ..	1855
Bayes, T. W., Esq., Calcutta, ..	1864
Bayley, E. C., Esq., Civil service, Calcutta, ..	1863
Bayley Stuart Colvin Esq., Civil service, Calcutta, ..	1859
Beadon, Honble C. Civil service, Calcutta, ..	1855
Bean, J. Esq., Sub-Deputy Opium Agent, Patna, ..	1850
Beatson, Dr. J. F. Surgeon, General Hospital, Allahabad, ..	1861
Beaufort, Francis L., Esq., Civil service, Calcutta, ..	1838
Beavan, Lt. R. C., Revenue Survey Dept., Barrackpore, ...	1864
Becher, William, Esq., Gowhatti, ..	1855
Becher, J. M. Esq., Indigo-plater, Narah Factory, Tirhoot, ..	1862
Begg,† Dr. D., ..	1850
Bell,† J. D., Esq., Barrister-at-law, ..	1855
Belli, C. H., Esq., Civil service, Rampore Bauleah, ..	1863
Bennett, T. B., Esq., Indigo-planter, Purneah, ..	1854
Bennett, † T. H. Esq., Merchant, ..	1857
Bennertz, T. H., Esq., Merchant, Calcutta, ..	1862
Benson, Major, J. C., Madras Army, Moulmein, ..	1863
Bentall*† Edward, Esq., Civil service, ..	1837
Berkeley, L., Esq., Sudder Ameen, Lahore, ..	1855
Berkeley† R., Esq., ..	1857
Bhowany Sing,* Moharajah, Duttea, ...	1864
Biddle John, Esq., Proprietor, N. W., Dak Compy. Umballah, ..	1864
Bindabun Chunder Mittra Baboo, Calcutta, ..	1853
Bird, Saml, Esq., Merchant, Allahabad ...	1863
Bishop,*Major H. P., (Artillery,) Benares, ..	1853
Bissumbhur Sing, Baboo, Zemindar, Soorool, ..	1857
Blacker, G. M., Esq., Merchant, Calcutta, ..	1856
Blandford, A. Esq., Indigo-planter, Turtipore, ..	1864
Blechynden, R., Esq., Merchant, Calcutta ..	1868
Blechynden, A. H. Esq., Secy. Agri-Horticultural Socy. of India ..	1851
Bonavia, E., Esq., M. D., Assist. Surgeon, Lucknow, ...	1859
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Admitted

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Begt. Kohat, Punjab,	1860
Braddon,† Henry Edward Esq.,	1860
Brae, T., Esq., Indigo-planter Hatberria, Jessore,	1854
Brandis,† Dr., D. Supt. of Forests, ..	1857
Brett,† Walter, Esq.,	1861
Brice,† N. Esq.,	1859
Bridgman,† J. H., Esq., Indigo-planter,	1856
Brine, F. B., Esq., Nahore near Darjeeling,	1863
Bristow, Major J. W., (19th N. I.,) Depy.-Comr., Jheelum, Punjab,	1855
Brodhurst, M. Esq., Civil service, Ghazeepore, ..	1859
Brodie,*† Major, T.,	1836
Brooke,† Lieut.-Col. John, C.,	1843
Broome, Col. Arthur, Royal Artillery, Calcutta, ..	1864
Brouke, W. J., Esq., Indigo-planter, Gya Depôt, Batteah,	1859
Browne, J. F., Esq., Civil service, Tipperah, ..	1862
Brown, Forbes Scott, Esq., Merchant, Penang, ..	1840
Brown, Lieut.-Col. D., 1st Madras Fusiliers, Assist.-Com- missioner, Moulmein,	1856
Brown,† George, Esq., Merchant,	1856
Brownlow, Charles, Esq., Manager, Kunchunpore Tea-Com- pany, Cachar,	1862
Brownlow, H. Esq., Tea-planter, Cocheela, Cachar, ..	1862
Brownlow,† Major H. A., (Engineers),	1858
Bruckner,† A., Esq., Merchant,	1860
Brundell, R. S., Esq., Resident Engineer E. I. Railway, Jub- bulpore,	1862
Buchanan, George, Esq., Merchant, Moulmein, ..	1862
Buckle, W. B., Esq., Civil service, Berhampore, ..	1860
Bullen, John, N. Esq. Merchant, Calcutta, ..	1859
Buller,*† Fredrick Pole, Esq., Civil Service, ..	1837
Bunbury, Capt. W. D., Futtehpore,	1861
Burbank, Capt. C., Emigration Agent, Calcutta, ..	1863
Burgett, C. F., Esq., Merchant, Calcutta, ..	1863
Burkitt, W. R., Esq., C. S. Gorruckpore, ..	1863
Burnell, Lieut. J., Executive Commissariat Officer, Haza- reebaugh,	1862
Burnell, W. J., Esq., Indigo-planter, Bhowgong, Purneah,	1862
Burrows, Henry, Esq., Railway Contractor, Shahabad, ...	1860
Burton, John St. Edmund, Esq., Calcutta,	1850
*Buskin, E. G., Esq., Calcutta,	1864
Buzlall, Ruhim, Moonshee, Zeminder, Sealdah,	1857
CAMPBELL, Alxr. S., Esq., Managing Proprietor, Western Assam Company, Luckimpore,	1863
Campbell, W. F., Esq., Tipperah,	1838

	<i>Admitted.</i>
Campbell,*† Archibald, Esq., M. D.,	1838
Campbell, T. A., Esq., Dehree,	1851
Campbell, Archd. Esq., Extra Asst. Commr. Assam, ...	1861
Campbell, John, Colin, Esq., Calcutta,	1864
Campbell, R. Lt. Coll., H. M.'s., Bengal staff, Gowhatti, ..	1864
Campbell, John, Macdonald, Esq., Tea Planter, Dyapore Concern, Cachar,	8864
Caréw,* R. R., Esq.,	1846
Carnegy, P., Esq., Assist.-Commissioner, Fyzabad,...	1857
Carrick,† Henry, Esq., Locomotive Supt. E. B. Railway,	1863
Carter, T. E., Esq., Merchant, Calcutta,	1863
Cave, H. S., Esq., Indigo-planter, Purneah,	1852
Cavenagh, Lieut.-Colonel, O., Governor of the Straits Set- tlements, Singapore,	1848
Cayley, H., Esq., Civil Surgeon, Simlah,	1861
Chamberlain, Major. Chas., Commdt. 23rd N. I. Peshawar,	1859
Chamberlain, Major T. H., (3rd European Regiment), Asst. Supt. of Thuggee, Lucknow,	1860
Chandler, E. J., Esq., Sub-Collector, Cawnpore,	1860
Chardon, W. R., Esq., Doudnuggur, Shahabad,	1864
Cheke, J. M. G., Esq., Bancoorah,	1860
Chichester Lieut. Coll. the Hon. A. G. C., H. M.'s 77th Regiment, Bareilly,	1861
Chrestien, T., Esq., Mungulpore,	1864
Churcher, E. J., Esq., Mehndy Ghat near Kanouj,	1864
Clark, Dr. Stewart, Inspector Genl. of Prisons, N. W. P.,...	1855
Clarke, H. R., Esq., Civil service, Banda,	1856
Clarke, G. R., Esq., Indigo-planter, Rooderpoor, <i>via</i> Bon- gong,	1855
Cleghorn, Dr. H., Calcutta,	1858
Clerk, Dr., D. G., Calcutta,	1856
Clerk, Lieut. Malcolm G., (D. P. W.) Rawal Pindie, ..	1858
Cockburn, W., Esq., Raneegunge,	1846
Cockburn, Wm., Esq., Indigo-planter, Doomra, Tirhoot, ...	1861
Cockerell, F. R., Esq., Civil service, Calcutta,	1863
Cockerell,† Capt. J.,	1860
Cockerell, Horace Esq., Civil service, Allipore,	1861
Collins, W. B., Esq., Assistant to the Fort Adjutant, Fort William,	1863
Collins, S. E., Esq., Solicitor, Calcutta,	1859
Colville,*† Sir J. W.,	1849
Colvin, J. C., Esq., Civil service, Seetapore, Oude,	1861
Comber, Capt. A. K., Assist.-Commr. Luckhimpore, Assam,	1862
Commanding, Officer—19th Hussars, Meerut,	1854
Cornell,† W., Esq., Civil service,	1861
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Admitted.

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Cosserat, Lewis, Esq., Indigo-planter, Burhogah, <i>via</i> Sewan,	1859
Cossinauth, Chowdry, Baboo, Cossipore,	1849
Opurjon, Alfred Esq., Zemindar, Tipperah,	1863
Cowie,* Henry, Esq., Merchant,	1837
Craster, E. C., Esq., Civil service, Howrah,	1858
Crawford, J. A., Esq., Civil service, Calcutta,	1857
Creswell, C. E., Esq., Merchant, Calcutta,	1855
Crommelin, C. R., Esq., Roy Bareilly,	1860
Crommelin, Lieut.-Col. J. A., Darjeeling,	1857
Crooke,† Henry, Esq., Merchant,	1858
Crump, R. W., Monjoul Factory, Monghyr,	1859
Cumming, William, Esq., Indigo-planter, Rajmehal,	1851
Currie, Charles, Esq., Civil service, Lucknow,	1855
Curtis, J. F., Esq., Indigo-planter, Ramcollah, Chuprah,	1860
DACRUZ, J. F., Esq., Indigo-planter, Chynepore, Shahabad,	1861
Dalton, Lt. Col. E. T., Commissioner of Chota Nagpore,	1848
Dampier, H. L., Esq., Civil service, Calcutta,	1857
Davis, C. T., Esq., Solicitor, Calcutta,	1854
Dashwood, H. W., Esq., Civil service, Banda,	1860
Davies, J. H., Esq., District Supdt. of Roads, Malda,	1859
Davies, Major J. S., Judicial-Commissioner, Chota Nagpore,	1857
Davis, H. M., Esq., Civil Surgeon, Noacolly,	1856
Dear, Herschel., Esq., Monghyr,	1860
Dearman,† George, Esq., Merchant,	1845
Degumber Mitter, Baboo, Merchant, Calcutta,	1858
Dejender Nauth Tagore, Baboo, Calcutta,	1863
Delane, Major, G., Commanding. G. G's. Body Guard, Dehra,	1864
Delauney, P. J., Esq., Indigo-Planter, Tipperah,	1862
Dennehy,† Capt. T.,	1860
DeSaran, Eugene Dubois, Esq., Culna,	1858
Deverell, H., Esq., Indigo-planter, Ackrigunge Factory, Berhampore,	1854
Dickens, Lt. Col. C. H., Artillery, Central Provinces, Nagpore,	1856
Dickson, G. Esq., Secy. and Treasurer Bank of Bengal, Calcutta,	1863
Dillon, Dr. Thomas, Lucknow,	1862
Dodgson, W., Esq., Kallygunge, Factory, Rungpore,	1864
Dolmage, Lt. J. A., Police Corps, Cuttack,	1862
Dombal, M. E. Durup de, Esq., Monghyr,	1860
Doorgapersaud, Baboo, Zemindar Etah,	1864
Douglas† Stewart, Esq., Merchant,	1852
Doveion, H., Esq., Deputy-Magistrate, Buheera. Tirhoot,	1855
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	<i>Admitted.</i>
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Drew, Capt. C. M., Kandy, Ceylon,	1864
Drummond,† The Hon'ble R., Civil service, ..	1862
Drury, Major, C. C., Police Dept. Goruckpore, ..	1860
Dunlop, H. G. Esq., Calcutta,	1863
Dunne, A. P., Esq., Indigo-planter, Dacca, ..	1862
Dyer, E., Esq., Genl. Manager, Murree Brewery Company, ..	1862
 EAMES, R. Esq., Merchant, Calcutta,	 1855
Earle, Dr. F. J., Civil Surgeon, Kishnaghur, ..	1859
Eddis, W. U., Esq., Merchant, Calcutta,	1858
Egerton, R. E. Esq., C. S. Nagpore,	1864
Eliot,† Col. John, Artillery,	1839
Elliot, Fredrick, Eden, Esq., Bengal Civil service, Goruck- pore,	1862
Elliot,† J., Scott, Esq., Merchant,	1851
Elphinston, Major, N. W., Deputy Commissioner, Jullunder, ..	1861
Elwyr, Capt. W., Cantonment Magistrate, Peshawur, ..	1862
Erskine, H. C., Esq., Indigo-planter, Elambazar. Paneeghur, ..	1855
Eshanchunder Bose, Baboo, Merchant, Calcutta, ..	1848
Ewing, R. L. Esq., Indigo-planter, Belowhee, Kultea, Sha- habad,	1863
 FADDY,† Lt. Coll. S. B.,	 1851
Fagan, G. S., Esq., Barrister Supreme Court, Calcutta, ..	1855
Falcon, A. B., Esq., Civil service, Mymensingh, ..	1858
Fane,† Edward, Esq., Madras Civil service,	1860
Finch J. Esq., Indigo-planter, Tirhoot,	1863
Firminger,† Rev. T. A. C.,	1851
Fischer Max. Esq., Merchant, Hongkong,	1863
Fitzpatrick, W., Esq., Monghyr,	1860
Fitzwilliam,† Wm. Shelford., Esq.,	1856
Fleuning, Dr. J. M. Barrackpore,	1864
Flint Capt. Jas. 38 M. N. I. Acting 1st Asst. District Engr. D. P. W. Uuuntopore, Bellary,	1863
Foord,† E. B., Esq., Madras Civil service,	1858
Forbes, Capt. H. T., Bhaugulpore,	1856
Forbes, Lieut. W. E., Royal Artillery, Sultanpore, Oude, ..	1864
Forlong, James, Esq., Durbunga,	1850
Forlong, Major J. G. R., Supg. Engr. 3rd Circle, Agra, ..	1861
Forrest Robert, Esq., Superintendent Dhoon Canals, Etawah, ..	1861
Forsyth, Lieut. J., Offg. Conservator of Forests, Central Pro- vinces, Nagpore,	1862
Fowle, Capt. E., Secy. A. and H. Society, Rangoon, ..	1864
Frazer Capt. Alexander, Bengal Engineers, Superintendent, Alguada Reef Light House, Moulmein,	1861

	<i>Admitted</i>
French, Henry, G. Esq., Burdwan,	183
French, E. J. Esq., Tea-planter, Jorehaut, Upper Assam, ..	186
Fressanger, J. S., Esq., Merchant, Cuttack,	186
Fyche, Col. A., Comr. Moulmein,	184
GALE, John, Esq., Pundoul factory, Tirhoot,	185
Galiffe, J. F., Collector of Canal Tolls, Calcutta,	185
Garnault, Lt. H. W., Executive Engineer, Burdwan,	185
Garrett, C. B., Esq., Civil service, Calcutta, .. & ..	186
Garstin, Genl. Edward, (Engineers,) Ootacamund,	188
Garstin, J. W., Esq., Deputy Magistrate, Buxar,	186
Gausson, Lt. Coll. D. Dehra-Doon,	186
George, Adam, Esq., Calcutta,	185
Gibbon, T. M. Esq., Indigo-planter, Turcooleah Factory, Tirhoot,	186
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Glinn, G. J. H., Esq., Engineer, E. I. Railway, Colgong, .	185
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